HMI • SCADA • MES Software

User Manual

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Introduction

Part I

1 Introduction

1.1 Welcome to Ignition

Welcome to *Ignition by Inductive Automation*, the next generation of accessible, scalable, and data-centric HMI/SCADA/MES software. Ignition was designed from the ground up to be approachable and easy to get started with, but highly flexible and capable of scaling up to the largest projects.

This guide aims to introduce you to Ignition and its architecture, get you started quickly, and then provide all of the reference resources you should need as you become more proficient with the system.

We recommend proceeding through this manual roughly in the order that it's laid out. In particular, we recommend starting with the following topics:

What is Ignition?
Architecture Overview
Quick Start

But how do I...?

Of course, it would be impossible for us to anticipate every question or goal a reader might have, and therefore we strive to be as approachable and helpful as possible. The Getting Help section outlines a variety of ways that you can find answers to any questions that might not be answered here. Additionally, we encourage users to contact us with feedback about the product or this manual. Our goal is to always provide powerful and straight-forward software that solves problems, and to this end we rely heavily on the feedback of our users and integrator partners.

1.2 Getting Help

If you get stuck designing a system in Ignition, don't worry! There are lots of ways to get help.

User Manual Search

The Ignition User Manual has a search feature as well as an index that tend to often get overlooked. The index can sometimes be a little more helpful when you are not yet familiar with the layout of the user manual and where certain topics are located within the content hierarchy. The search feature allows you to enter keywords and search the entire manual returning results ordered by relevance. Both of these features will help you get the most out of the Ignition User Manual.

Online Forum

One of the most effective ways to get help is our active user forum. The forum is always available, and is actively patrolled by Inductive Automation staff and many knowledgeable users. Chances are you will find your question already answered in an existing post, but if not you can be assured that yours will receive a quick reply. The forum can be found under the *Support* section of the Inductive Automation website.

Phone Support

You can reach us during business hours 8am-5pm PST at 1-800-266-7798. Support charges may apply. 24-hour support is also available, at an additional fee.

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E-Mail Support

E-mail support is available at support@inductiveautomation.com

1.3 Licensing, Activation, and Trial Mode

How the trial mode works

Ignition can be used for 2-hours at a time, with no other restrictions. At the end of the demo period, the system will stop most functions. For example, transaction groups will stop logging, and clients will show a demo screen. By logging into the gateway, you may re-start the demo period, and enable another 2 hours of execution. The demo period may be restarted any number of times.

All portions of the gateway (and therefore, all modules) share the same clock and will timeout simultaneously.

How licensing works

Ignition is a modular platform, and therefore, is licensed based on modules. Licensed and un-licensed modules can operate side-by-side, so some modules can be tested in trial mode while others run in a licensed state.

Despite the modular licensing, each server only has a single **CD-Key** and license file. That is, there is a single license file that dictates which modules are currently activated.

When module(s) are purchased, you will receive a "cd-key" - a six digit code that identifies your purchase. You then use this cd-key to *activate* the software, through the Ignition Gateway. Activation is a process by which that cd-key and its associated parameters get locked to the machine that you are activating. If you are adding an additional module, your account will be updated, and you can re-use your existing cd-key to activate the new features.

It is possible to un-activate your cd-key, freeing it for activation on a different machine.

How activation works

Activation, as mentioned above, is the method by which a cd-key is locked down to the install machine, and the modules are notified of their license state. It is a two step process that can be performed automatically over the internet, or manually through email or through the Inductive Automation website.

Step 1 - Enter CD-Key
When the software is purchased, you are provided with a six digit *cd-key*. After logging into the gateway configuration, go to `Licensing > Purchase or Activate`, and select "Activate". Enter your cd-key.

Step 2a - Activate over Internet
If your computer has internet access, activating over the internet is the easiest option. A secure file will be created with your cd-key, and sent to our servers. The response file will then be downloaded and installed, completing the entire process in seconds.

Step 2b - Activate Manually
If you do not have internet access on the installation machine, you must activate manually. In this process, an activation request file is generated (`activation_request.txt`). You must then take this file to a machine with internet access, and email it to support@inductiveautomation.com, or visit our website to activate there. Either way will result in a license file (`license.ipl`) being generated,

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which you then must take back to the Gateway machine and enter into the License and Activation page.

License Reloading

If you purchase additional modules, they will be added onto your existing CD-Key. To update your license, you must *reload* it, which can be performed from the same location in the gateway as activation.

Transferring Licenses

If you would like to transfer your license from one machine to another, simply *unactivate* the currently licensed machine. This process is similar to the licensing procedure, but in reverse. If the licensed Ignition server has internet access, the unactivation will occur immediately, and the license will again be available for activation. If you do not have internet access, an unactivation request file will be generated, and the license will not be allowed to activate until the file is loaded into the Inductive Automation website, or emailed to support.

Emergency Activation

Licenses may only be activated one time. After that, if not properly unactivated, you must call Inductive Automation in order add another license grant to your cd key. However, in cases where activation is not possible, the system will be activated in *emergency mode*. In this mode, a temporary activation is granted that will run for 7 days, in order to provide you with enough time to contact us. The presence of an emergency activation will be displayed when logged into the gateway configuration, but will not otherwise affect clients or functionality.

1.4 Quick Start

1.4.1 Gateway Homepage

The Ignition Gateway is a web server. When it is running, you access it through a web browser. For example, if you are logged into the computer that you installed Ignition on, open up a web browser and go to the address:

```
http://localhost:8088
```

and it will bring up the *Gateway Homepage*, pictured here.

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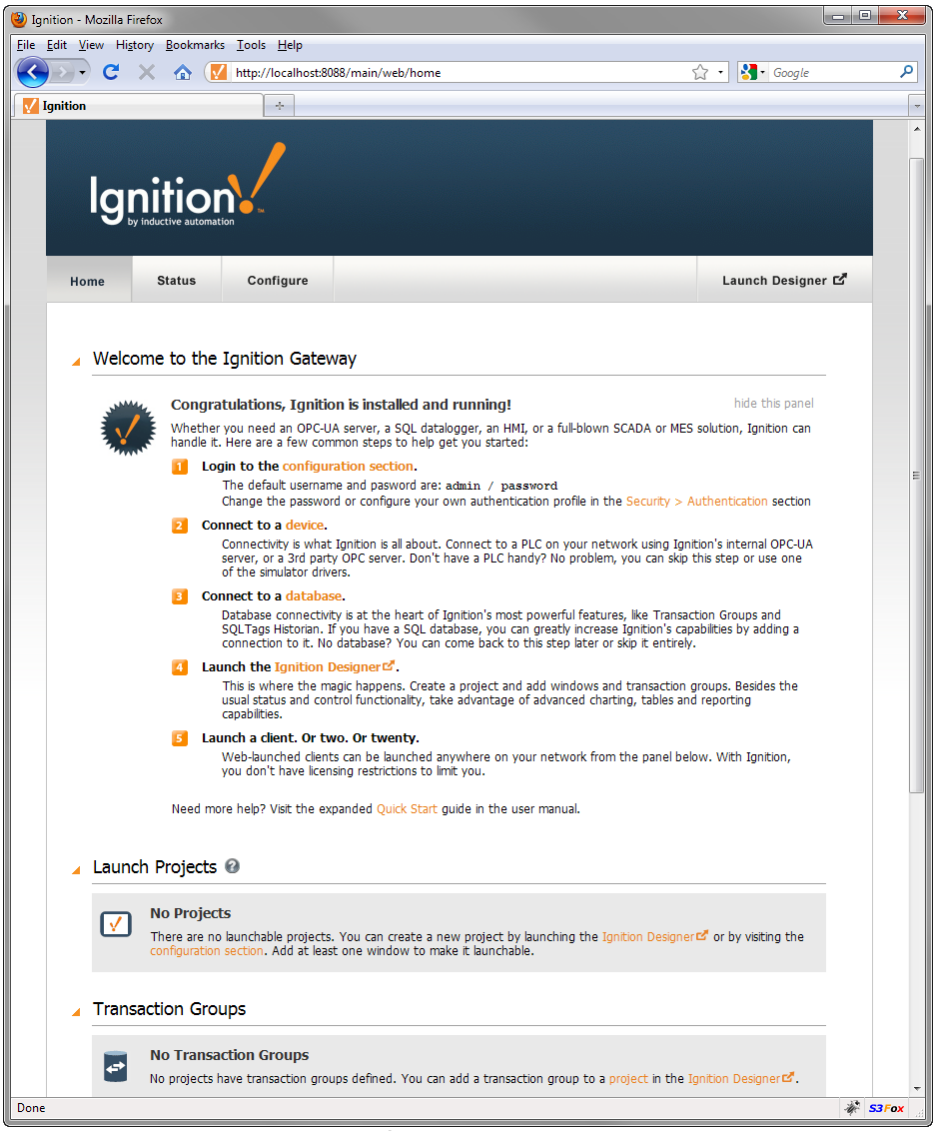
Ignition - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost:8088/main/web/home
Ignition
Ignition
by inductive automation
Home
Status
Configure
Launch Designer
Welcome to the Ignition Gateway
Congratulations, Ignition is installed and running!
hide this panel
Whether you need an OPC-UA server, a SQL datalogger, an HMI, or a full-blown SCADA or MES solution, Ignition can handle it. Here are a few common steps to help get you started:
1 Login to the configuration section.
The default username and pasword are: admin / password
Change the password or configure your own authentication profile in the Security > Authentication section
2 Connect to a device.
Connectivity is what Ignition is all about. Connect to a PLC on your network using Ignition's internal OPC-UA server, or a 3rd party OPC server. Don't have a PLC handy? No problem, you can skip this step or use one of the simulator drivers.
3 Connect to a database.
Database connectivity is at the heart of Ignition's most powerful features, like Transaction Groups and SQLTags Historian. If you have a SQL database, you can greatly increase Ignition's capabilities by adding a connection to it. No database? You can come back to this step later or skip it entirely.
4 Launch the Ignition Designer.
This is where the magic happens. Create a project and add windows and transaction groups. Besides the usual status and control functionality, take advantage of advanced charting, tables and reporting capabilities.
5 Launch a client. Or two. Or twenty.
Web-launched clients can be launched anywhere on your network from the panel below. With Ignition, you don't have licensing restrictions to limit you.
Need more help? Visit the expanded Quick Start guide in the user manual.
Launch Projects
No Projects
There are no launchable projects. You can create a new project by launching the Ignition Designer or by visiting the configuration section. Add at least one window to make it launchable.
Transaction Groups
No Transaction Groups
No projects have transaction groups defined. You can add a transaction group to a project in the Ignition Designer.
Done
S3Fox

The Gateway Homepage with Quickstart Steps

The first time you go to the Gateway Homepage, It will show you 5 common steps to help you get started. You can follow along with these steps and/or with this quick-start guide - they follow the same basic workflow.

The Configuration Section

The first step is to log into the Gateway's *Configuration Section*. To do this, click on the large "Configure" button in the top navigation bar.

You will be asked to log in - the default username/password is: `admin / password`

Once you are in the configuration section you can navigate to the various configuration areas using the menu tree on the left-hand side of the page. Learn more about using Gateway's web interface in the Gateway Navigation section.

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1.4.2 Connect to a PLC

Now that we've installed Ignition and have logged into the Configuration section of the web interface, lets install a *device.* A device is a named connection to an industrial device like a PLC. There are also "simulator" devices that you can add that will mimic a connection to a real device in case you don't have one handy.

This step is optional! You can come back to it later if you'd like. The next steps will be more interesting if you add a device now, however.

These devices are part of the integrated Ignition OPC-UA server module. If you have a *classic* OPC server (OPC-DA 2.0 or 3.0) that you'd like to connect to, see the OPC-COM Module.

Adding a Device

To add a device, use the left-hand side configuration menu to go to the **OPC-UA > Devices** section. Once at the Devices page, click on the **Add a Device...** link at the bottom of the table.

Choose a Driver

You will be given the option to pick the *driver* for the device you want. If you don't have a device that matches one of the available drivers, you can add a simulator device so you have some data to play with.

Configure the Device

After you choose the driver, you'll need to give your device a name and set some options. Typically, the options are just an IP address to connect to. See the documentation for your specific driver for more details.

After configuring the device, simply press the "Save" button to add your device. You can check the connectivity status of your device in the Gateway Status section, under Ignition OPC-UA Server.

1.4.3 Connect to a Database

Many of the advanced features of Ignition, such as the Transaction Groups and SQLTags Historian require a connection to an external database. If you don't have a database, like Microsoft SQL Server, MySQL, or Oracle installed, don't worry - **you can come back to this step later**.

Add a Database Connection

Make sure you are in the Gateway Configuration section of the Gateway's web interface. To connect to a database, use the left-hand side configuration menu to go to the **Databases > Connections** section. Once at the Database Connections page, click on the **Create new Database Connection...** link at the bottom of the table.

Pick a JDBC Driver

Database connections in Ignition are powered by *JDBC drivers*. Ignition ships with drivers for Microsoft SQL Server, MySQL, Oracle, and PostgreSQL. Adding a new JDBC driver for other databases, like IBM DB2, is not very difficult, see Adding a JDBC driver.

Pick the JDBC driver your database, and click on the "Next >" button.

Configure the Connection

Each database connection needs a name, which should consist of letters, numbers and underscores.

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The *Connect URL* parameter is the most important parameter of the connection. This parameter defines where the database server is on the network, and what database to connect to. Each database's connect URL is slightly different. Follow the instructions given for the driver you chose.

The *Extra Connection Properties* field is used less frequently, but is important for some drivers, such as SQL Server's driver. It is a semi-colon separated list of key-value pairs. Each driver has its own set of property keys that it accepts.

The *Username* and *Password* fields are used to supply credentials to the database connection.

For example, suppose we wanted to connect to a database named "ProcessDB" on the server at IP address 10.0.25.122. Here are some examples for the different databases:

Microsoft SQL Server	`jdbc:sqlserver://10.0.25.122\InstanceName`
	with extra connection properties:
	`databaseName=ProcessDB`

MySQL	`jdbc:mysql://10.0.25.122:3306/ProcessDB`
Oracle	`jdbc:oracle:thin:@10.0.25.122:1521:ProcessDB`
PostgreSQL	`jdbc:postgresql://10.0.25.122:5432/ProcessDB`

When you are done configuring your database connection, click on the "Create New Database Connection" button to continue. You can check the status of your database connection in the Gateway Status section under Database Connections.

1.4.4 Launch the Designer

Now that we have some connections set up (or not, if you skipped the last two steps. They were optional, after all), we'll *web-launch* the Designer.

Web-Launching

Web-launching is one of the best parts about Ignition. This is how we launch both the Designer, which is where you'll configure your projects, and our Ignition Vision Clients. Web-launching is a technology that lets you launch a full-fledged application with zero installation just by clicking a link on a webpage. This means that with Ignition, you'll only ever need to *install* the Gateway. All of your Clients and Designers do not need to be installed, and they are always kept up-to-date. Once you start using web-launched clients, you'll wonder how you ever did without them.

In order to successfully web-launch, you'll need Java 5 or Java 6 installed. If you're on the computer that's running the Ignition Gateway, you already have Java installed - the Ignition installer made sure of that. If you're on a computer that is accessing the Gateway over the network, the Java Detection panel on the bottom of the Gateway's homepage will detect whether or not Java is installed.

Launch the Designer

To launch the Designer, simple press the big "Launch Designer" button in the upper right-hand corner of any Gateway page. Once the Designer starts up, you'll see the login pane. The default username for the Designer is the same as for the Gateway Configuration section: `admin` / `password`

The next window will prompt you to open a project. You don't have any projects yet - so click on the " Create New" tab. Enter a name for your new project (no spaces!) and press the "Create" button. That's it - you're now editing your project!

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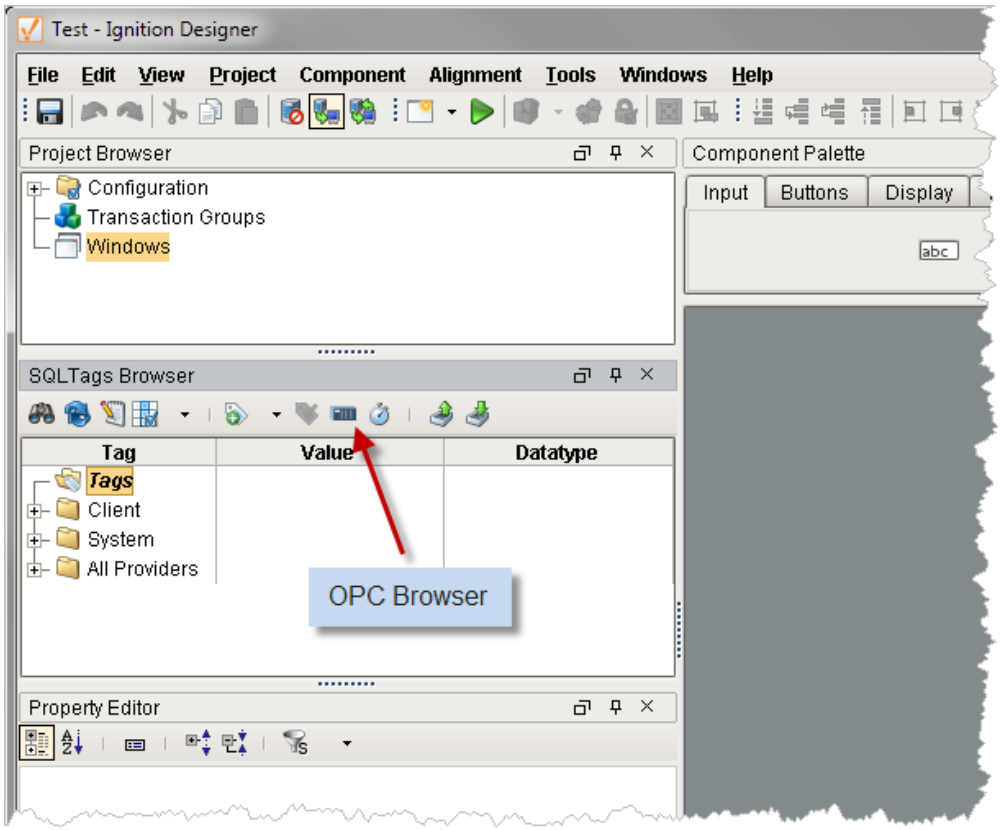
1.4.5 Create some tags

Once you're in the Designer, a good first step is to create some tags. You'll use these tags for realtime status and control and to store history with the SQLTags Historian.

Drag-and-Drop from OPC

If you created a *device* in the earlier step, the easiest way to create some SQLTags is through drag-and-drop. Select the "***Tags***" folder, and then click on the device icon to bring up the OPC Browser.



The OPC browser button

Now you can browse all of your OPC connections. By default you've got a connection to the internal Ignition OPC-UA server, which has the device in it that you created earlier. Browse the device and find some tags that you're interested in. Highlight the tags and drag them into the "***Tags***" folder in the SQLTags Browser panel.

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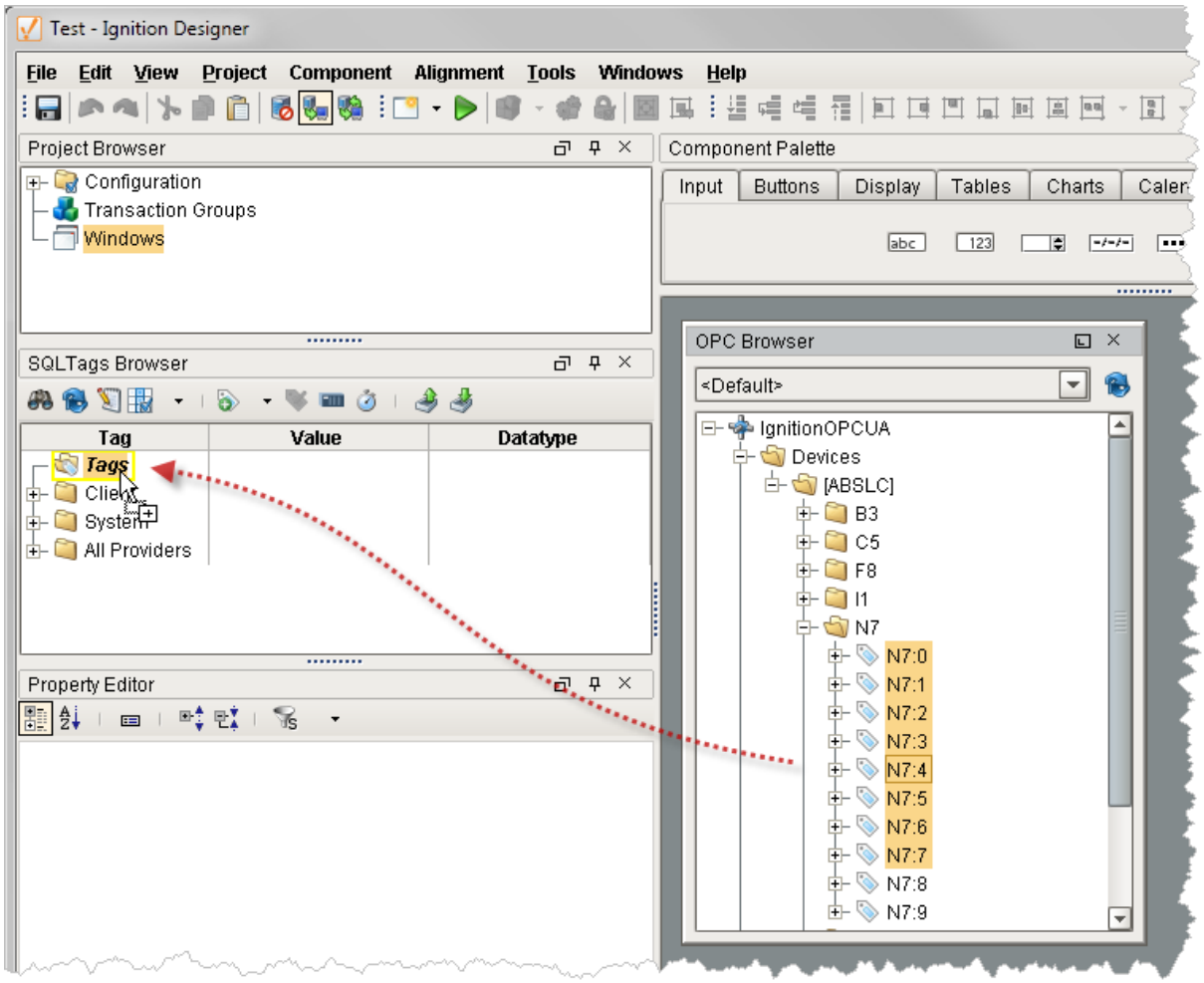

Creating SQLTags from the OPC browser

Thats it - you now have some SQLTags. You should see their values come in and start updating.

1.4.6 Create a Window

Lets create a window so we can use our SQLTags for some basic status and control. Click on the **New Window** ( ) icon in the toolbar or use the **File > New > Window** menu item.

SQLTags are used in windows to power property bindings on components. The easiest way to make some components that are bound to SQLTags is to simply drag and drop some tags onto your window.

When you drag a SQLTag onto a window, you'll get a popup menu asking you what kind of component to make. You can *Display* the tag with some components, and *control* the tag with other components. Drag a few tags onto the screen to experiment with the different options.

As you're editing your project, you can hit the Save ( ) to save you changes. In Ignition, you're not editing a *file*. Your Designer is linked up to the Ignition Gateway. When you hit save, the project is saved back on the central Gateway. Any running Clients would be notified that there is a new version of the project available.

See also:
Creating Components / SQLTags Drag-n-Drop

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1.4.7 Launch a Client

Now that we've created a window, lets launch a client to see it in action. Make sure you've saved your project, and then go back to the Ignition Gateway homepage. Your project will appear in the Launch Projects panel with a big **Launch** button its right. Click on the launch button to start up a Client.

You'll need to log into the Client. By default, a new project uses the same user source as the Gateway - so the `admin` / `password` credentials will work.

Once you've logged in, you will see your window running. Now go back into the Designer and make a change to the window and hit **Save**. Your Client will show a notification that there are updates to the project. Click on the notification and the Client will update itself.

Thats it - you can launch as many clients as you want! Try it out - if you've got other computers on the same network as the Gateway computer try launching on them too. Make sure that your Gateway computer doesn't have a Firewall enabled, or if it does, it is allowing traffic on port 8088 - the default port for the Ignition web server.

See also:
Web Launching

1.4.8 Create a Transaction Group

Transaction groups are used to store history, log events, synchronize databases tables with PLC, perform calculations, and many more data-centric tasks. To get started, let's create a basic History Group and start logging some PLC values to your database.

Switch the Designer to the Transaction Group *workspace* by clicking on "Transaction Groups" in the Project Browser panel.

Make a new Historical Group by clicking on **File > New > New Historical Group**. Your new group, named "Group" will be selected. The OPC-browser panel is now *docked* to the lower left side of the screen. Browse your OPC device again and drag some OPC tags into the **Basic OPC/Group Items** section.

Your group starts out *disabled*. To enable logging, press the **Enabled** button above the item tables. You can also change the **Table Name** field under the **Action** tab to name your table something interesting.

Right now your group only exists in the Designer - you need to **Save** the project to **start the group**. Groups execute on the Ignition Gateway. Save your project now.

Your group is now running, logging data to your database connection. To see the data, you can use the Ignition Designer's built-in database query browser. The easiest way to do this is to click on the Query Browser ( ) button to the right of your group's Table Name field. The Query Browser is a convenient way to directly query your database connection without leaving the Ignition Designer. Of course - you can also use any query browser tools that came with your database.

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FAQ

Part II

2 FAQ

The FAQ section is a great place to start for those new to Ignition and are looking for answers to common questions. This section is less of a "how-to" section and more of a specially tailored index designed to make navigating the Ignition user manual a little bit easier for users that are not yet familiar with the terminology used when referring to concepts within the Ignition system. Included topics are phrased in a friendly "how do I" manner and link to a section that briefly describes the topic and then links to other areas of the user manual that provide the information required to achieve the desired task. By reading through the FAQ you will start to see that many tasks in Ignition have multi-step solutions and require you to touch different components of the Ignition software. Working through some of these "simple" tasks will allow you to glean a better understanding of how the different pieces of Ignition are tied together and afterwards should feel a little more comfortable with the organization of the user manual.

While walkthroughs of how to accomplish these common tasks are included in each FAQ subsection, they are not intended to be exhaustive references on the topics being dealt with. The links provided to other sections of the user manual contain further information about the topics at hand and should be read in order to gain complete insight to the different Ignition features presented. Some of the links only link to the first entry of a larger section, so it is important read through the topic in its entirety to better understand how the different features of Ignition work.

2.1 How to I get data from my PLC?

Getting data from your PLC into Ignition is a two step process: add a device, add some tags. It requires you to touch both the Ignition Gateway and the Ignition Designer. There are also some limitations as to what kind of devices you can connect to Ignition and these are explained throughout the user manual, however included below is an overview of what you can expect when it comes to compatibility.

Brief summary of device connection in Ignition

Ignition can only connect directly to devices over ethernet.
Ignition can only connect directly to devices for which there is an Ignition device driver.
Included drivers:
Allen Bradley - ControlLogix 5500, CompactLogix, MicroLogix 11/1400, PLC-5, SLC 505
Siemens - S7-300, S7-400, S7-1200
Modbus - The Modbus driver will connect to any ethernet enabled device that uses the Modbus protocol
Ignition can connect to third party OPC servers via OPC-UA or OPC-DA (using the OPC-COM module) for devices that do not have a supported driver.

Related Links
OPC-UA - Overview of OPC-UA in Ignition
OPC-UA Architecture - Overview of the the OPC-UA architecture in Ignition
OPC-UA Server Settings - Description of the OPC-UA server settings that are configured in the Ignition Gateway
ControlLogix 5500 - Ignition ControlLogix driver settings overview
MicroLogix 1100/1400 - Ignition MicroLogix driver settings overview
SLC 505 - Ignition SLC driver settings overview
PLC-5 - Ignition PLC5 driver settings overview

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Adding a device to Ignition

Ignition Supported OPC-UA Device

Most commonly you will be adding a device that is supported by one of the built-in device drivers. The first step is connecting your device to Ignition. This is done through the Ignition Gateway Configuration section under the OPC-UA -> Devices page.

1. Click "Add a device..."
2. Select the driver for the device you wish to add
3. When adding a device you will notice that there are some common settings that are shared by all devices. You can find an explanation of these settings here: Adding a New Device
4. Specify any of the required device specific settings for the device (e.g. hostname, etc.)
5. Check the status of your device to see if it is connected.

As long as all the device information you entered was correct you should see your device in a "Connected" state. The only exception to this is if you chose to add a Siemens or Modbus device. Since these devices don't support the browsing of tags you will have to create and address some tags in the Ignition designer before the device will stop cycling from a connected to disconnected state.

If you need to address your tags for your Siemens or Modbus device you'll want to read about adding SQLTags in the Ignition Designer as well as how addressing works for the different protocols. You will have to first add a tag in the Ignition designer and then edit the OPC Item Path of the tag using the appropriate addressing scheme.
What is a SQLTag?
Types of SQLTags
Create some SQLTags
Modbus Addressing
Siemens Addressing

Adding Connection to 3rd Party OPC Server via OPC-UA

In the case that your device does not have an Ignition driver you may use a 3rd party OPC server to connect to your device and then have Ignition connect to the server as a client. If the OPC server talks OPC-UA then you can add a new OPC-UA server connection in the Ignition Gateway. Configuration will be different depending on what OPC server you are using but the following is an example of a popular solution, connecting to KEPServer viw OPC-UA.
Kepware OPC-UA Connection Guide

Adding Connection to 3rd Party OPC-Server via OPC-COM

The following section provides a detailed walk through on how to connect to an OPC server using the OPC-COM module. If Ignition doesn't have a driver for your device and you don't have an OPC server that talks OPC-UA then you will have to connection using the OPC-COM module.
Connecting to OPC Classic (COM)

Adding tags for Allen Bradley devices

SQLTags are how Ignition represents your PLC tags. You create SQLTags in the Ignition designer and then you can use these tags to store history or display PLC data in your projects.
For the most part Allen Bradley devices support browsing of tags in the PLC. There are a few exceptions like the MicroLogix 1200/1500 for which you will have to manually address your tags. For now we will focus on creating tags from devices that support browsing.

1. Open the Ignition designer
2. Drag desired tags from the OPC browser to the SQLTags browser as described here: Creating

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SQLTags (if you don't know what "tag provider" means don't worry, merely drag them into the "Tags" folder)

You should now see some tags in the SQLTags browser that show the current values of the respective tags in your PLC. Don't stop here. You should read through the related links below so you can learn more about SQLTags and how they work.

Related Links
SQLTags Configuration Overview - This is just the overview of SQLTags and their gateway side configuration. To get a full understanding of the SQLTags system you should read the rest of the entries in the SQLTags section.
What is a SQLTag? - Links to the start of the SQLTags section that deals with how SQLTags function in the Ignition Designer and how they are used in your projects.

2.2 How do I log history for a tag?

Ignition has several different ways for you to store tag history: SQLTags Historian, and Transaction Groups. Both have their benefits and their drawbacks, so knowing how you are going to want to access and use your tag history data in the future comes into play when selecting one option over the other. Each of these features have their own sizable sections in the user manual dedicated to explaining the ins and outs of how they function and you are encouraged to read these sections in their entirety.

Before You Can Store History

You need a device connected to Ignition and tags in the designer: How to I get data from my PLC?
You need a database connection: How do I connect to a database?
You need a SQLTags Historian provider configured in the gateway: Configuring SQLTags Historian

SQLTags Historian

Overview

The following section provides detailed information on this SQLTags Historian properties: History Properties
For an overview of how the SQLTags Historian works read the following: How SQLTags Historian Works

Items to Make Note Of

History is configured on a tag by tag basis.
Once configured tag data is managed for you.
Tag history settings can be set/manipulated in a CSV tag export as well as in the designer.
There is a history provider created for each of the configured database connections. Take care to note the tags being stored and their respective providers.

How to Turn on History for a Tag

1. In the Ignition designer, locate the desired tag in the SQLTags browser.
2. Edit the tag by right clicking and selecting "Edit Tag" or merely double click on the tag.
3. Select the history option, and then select "yes" to enable history.
4. Fill in the appropriate settings for the history properties. Refer to this section for property explanation and help: History Properties
5. Finally click ok and history will start being stored for your tag to the history provider you selected.

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Where Your Data is Stored
Your tag data is stored in the database connection associated with the selected history provider. Ignition creates and manages several tables within the database that the historian uses to not only store your data but also make it easily available within your Ignition projects. Data is partitioned out over multiple tables, spanning set time periods as specified in the configuration section of the history provider. This partitioning of the data allows for faster querying and data lookup from within your projects.

Accessing your stored data
You can access your stored historical data from within your projects in several ways:

The Easy Chart component allows for drag-and-drop functionality with historian enabled tags within the Ignition designer. Select any number of tags from the SQLTags browser and merely drag them onto an Easy Chart component you have placed on a window. Historical data for the selected tags will immediately begin to be displayed on the chart.

The data property of a table component can make use of the Tag History binding option. Here you can select from a list of available historical tags, specify a start and end date, and change the different modes for how your data should be returned. Using this option will display your history data for selected tags in a the table component that you can place on any of your project windows. Start and end dates can be bound to properties allowing the table data to be dynamic in regards to what time slice of data to be displayed. More information on the Tag History binding can be found here: SQLTags Historian Binding

Much of the power of Ignition is harnessed through event scripting and there are several built in scripting functions that allow you to query the Historian to get information about stored tag data. system.tag.queryTagHistory and system.tag.queryTagDensity are the scripting functions made available to you for access to your history data through scripting.

Pros of Using SQLTags Historian

Ease of setup
Drag and drop trending
Ignition managed historical database tables
Optional data compression

When SQLTags Historian may not be Ideal

You want to maintain a custom database schema for your historical data
Access to history data via custom/specialized SQL queries either through Ignition or third party software
Data needs to be stored on a complex trigger condition

Transaction Groups

Overview

An introduction to transaction groups and how they execute: Introduction and Execution Cycle
The different types of Transaction Groups: Standard Group, Block Group, Historical Group, Stored Procedure Group
Transaction Group Item types: Overview, OPC Item, Expression Item, SQLTag Reference
Other important aspects of a Transaction Group: Action Settings, Trigger and Handshake Settings, Advanced Settings

Items to Make Note Of

Different types of groups have different features, make sure you are using the type that best fits your needs

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OPC Items of a group are subscribed at the execution rate of the group, SQLTag references are subscribed at their own scan class rate
You specify the table to which the data gets written. If the table you specify doesn't exist and the auto-create feature is enabled Ignition will attempt to create the table for you.
You can create your tables beforehand and then select them in the table selector dropdown.
In non-block groups, each tag will be stored to a column.
Order of Item execution: tag values updated -> triggered expression items executed in top-to-bottom order -> tag items written to db/opc

Setting up a Basic Historical Group
A historical group is the simplest of the Transaction Group types. It's function is to write opc tag, expression item, and SQLTag values to the database. You still have the option to run the group on a trigger and change some of the advanced settings, but the direction of the group is strictly opc -> db.

1. In the Ignition designer click on the "Transaction Group" item in the Project Browser to change your workspace view to the Transaction Group edit view.
2. Right click the Transaction Group item in the project browser then select New Transaction Group -> New Historical Group
3. Navigate to the OPC Browser in the Ignition designer. If it is not visible you can open it by clicking on the View menu option then going to Panels -> OPC Browser.
4. Browse through your devices and locate the tags you wish to store history for and then drag them into the "Basic OPC/Group Items" area of the designer.
5. Read through the following sections and the configure your group to your needs: Action Settings, Trigger and Handshake Settings, Advanced Settings
6. Once you have your group settings configured make sure to edit the Target Name option for each tag so that it represents the column of the database table in which you wish to store the tag values.
7. Click Enable and then save your project.
8. Your group should now be running and data should be populating your database. If your group failed to start check the events tab of the group and double click any error messages that may have been reported to see why the group has failed.

Where is Your Data Stored
Your tag data is written using the database connection specified to the database table that was configured in the group. You can verify that your data is being stored by using the Database Query browser tool available in the designer. This tool allows you to run SQL queries against the selected database connection. You can open it any time in the designer by selecting it from the Tools menu.

Accessing your stored data
Like SQLTags historian you have several ways to access your stored data within your Ignition projects.
Once again, the Easy Chart allows you to display your stored data as a trend. There are no drag-and-drop capabilities when you are not using SQLTags Historian, but the Easy Chart does allow to set up what are known as Database Pens rather easily. Merely double clicking on an Easy Chart that resides on a window in the designer will bring up the Easy Chart Customizer. Clicking on the plus icon of the Database Pens section brings up the Edit Pen window that allows you to specify where the data for your pen resides. You merely have to give the pen a name, select the database connection, database table, and column where the data is stored.
Table components allow you display data brought back from a SQL query and the data property has two bindings that allow you to bring back data from your database. The SQL Query Binding and DB Browse Binding allow you to write and build queries to run against your database.
Several scripting functions allow you to run SQL queries against the database: system.db.runPrepQuery, system.db.runPrepUpdate are a couple of these functions that will return a dataset containing the results of your query.

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2.3 How do I run a SQL Query from a button?

Before you can run your query

You have to have a valid database connection set up in Ignition - How do I connect to a database?

Running a Query from a Button

There are several steps involved with query execution on a button press:

1. Add a button to your window
2. Write your script for the actionPerformed event of the button
    1. Determine which scripting function you need to use
    2. Handle the results of a SELECT query (if applicable)

Adding Your Button

You can add a button to your window by simply selecting it from the component palette in the designer and then clicking anywhere on your window. There are many different types of events you can add scripting to, but the main event associated with a button press is the actionPerformed event. To add a script to the actionPerfomed event or view all of the events the button supports, right click on the button you added to the window and select "Event Handlers".

The event handlers window provides you with a list of all the events available for the selected component, along with several script generation wizards for common tasks. In the cases where you wish to write your own custom script for an event, you will make use of the script editor tab. Any Python script added to this area will be executed when the event fires. You can find more information about the button component here: Button

Writing Your Script

There are some built in scripting functions that Ignition makes available for you to use when running queries against the database. Each function serves a different purpose, so the function you use will depend on what type of query you need to run and what sort of results you want to get back. The functions listed below are a couple of the functions that you're likely to use the most. Pay close attention to the options provided to you by each of the different functions. Options such as the ability to return auto generated key for insert queries can be extremely helpful and eliminate the need to hit the database multiple times. Examples of each of these functions can be found in their linked topic sections.

system.db.runPrepQuery - This function is used to run basic SELECT queries against your database using a special placeholder (?) to allow for dynamic query building.
system.db.runPrepUpdate - Allows you to run queries that modify your database in some way. This function also makes use of the (?) placeholder.
system.db.runScalarQuery - Returns only the value from the first column of the first row of your query.
system.db.createSProcCall, system.db.execSProcCall - These functions are used together to execute any stored procedures you may have in your database.

Once you determine the function that best suits the query that you want to run you have to add your script to the script editor section of the actionPerformed event for your button.
Example:

```
name = "John Doe"
```

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```
results = system.db.runPrepQuery("SELECT * FROM Customers WHERE Name = ?", [name])
```

Handling Results From SELECT Query
SELECT queries return resultsets in the form of PyDataSets. You can assign these results directly to the data property of a table on your window or any other dataset property you may have on a currently open window. Assigning the PyDataSet to a table will cause the table to refresh and then display the results from your query. The reference to your table (myTable) is unique so make sure you select it from the property browser:

```
myTable = event.source.parent.getComponent('Table')
myTable.data = results
```

Merely running a query and then assigning the resulting PyDataSet to a table is really no different than just binding the data property of the table to a SQL Query binding. Much of the time when you run a query in a script it is because you want to examine the resultset in the script and then do some action based on your findings. Python, like many other programming languages, provides looping capabilities that make iterating through a resultset quite easy. There is some basic information about Python Control Flow statements that you should read over as well as the section on dealing with looping through data in PyDataSets. Below is a quick example of looping through a PyDataSet

```
stmt = "select * from customers"
results = system.db.runPrepQuery(stmt)

#loop through the resultset and print the value in the lastname column
#for each row in the query results
for row in results:
    print row["lastname"]

#loop through the resultset and print each column value for each row
for row in results:
    for column in row:
            print column
```

The above example is very simple, but it shows how you can use for loops to loop through resultsets. Scripts that you implement in your projects will likely be a lot more complex and it may be difficult at first to determine how exactly they should be written in order to accomplish exactly what you need. These simple loops involving print statements are great for debugging and initial script development. Print statments (when run in the designer or client) get output to the console. You can access the console in the designer by selecting it from the Tools menu. Printing things out as your script is running helps you to see what is actually happening and compare it to what you think should be happening. When you are new to Python and scripting print statements will help you be able to better visualize what is going on and help you get a better grasp on how your script is functioning. Read through the Python section in the user manual starting with the About Python section for a quick tutorial and overview of how Python works.

2.4 How do I control who logs into a project?

The short answer to this question is that each project has a property called Required Roles that you set up in the designer. You can access the project properties window by clicking the Project menu item in the designer and then selecting the Properties option. The Required Roles option is located in the General section of the Project area. You can enter a comma separated list of role names that are required to access the project. If a user doesn't have the required role then they will not be able to sign into the project.

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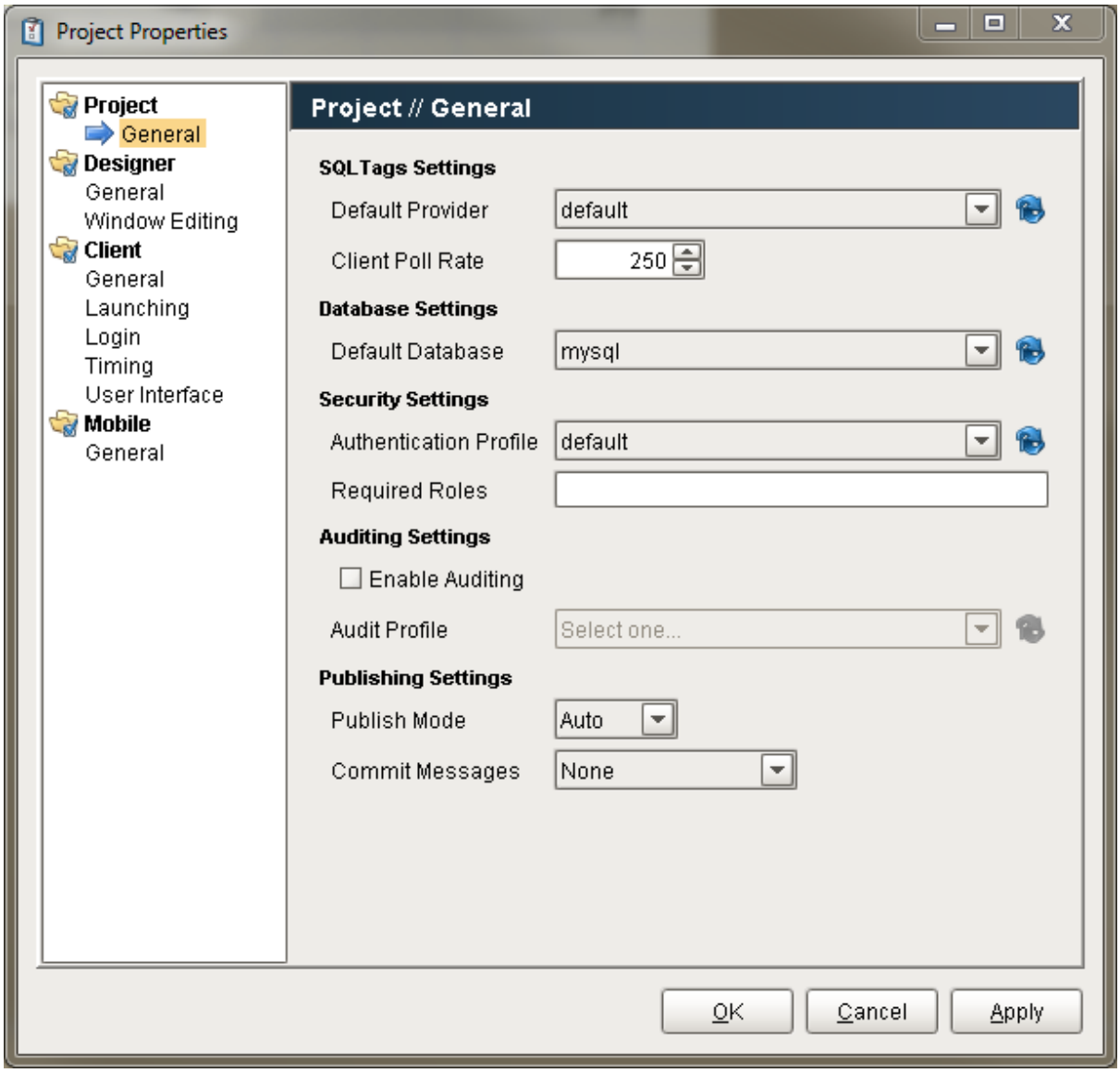

Ignition and Security

Ignition uses what's known as role based security. Logging in to the Gateway; logging in to a project; access to windows in a project; any type of security configuration relies on users and their associated roles. Users and all their associated roles are stored in *user sources* the you configure in the Ignition gateway. Take a look at the Security Overview section for a quick explanation of how security in Ignition works.

After finishing the initial installation of Ignition a *default* user source will be set up automatically for you to use. It is an internal profile that cannot be deleted but can be modified to include more users and roles.

The *default* user source

You can manage the default user source by navigating to the `Configure > Security > Authentication` section of the Gateway. The manage users link will allow you to add new users,

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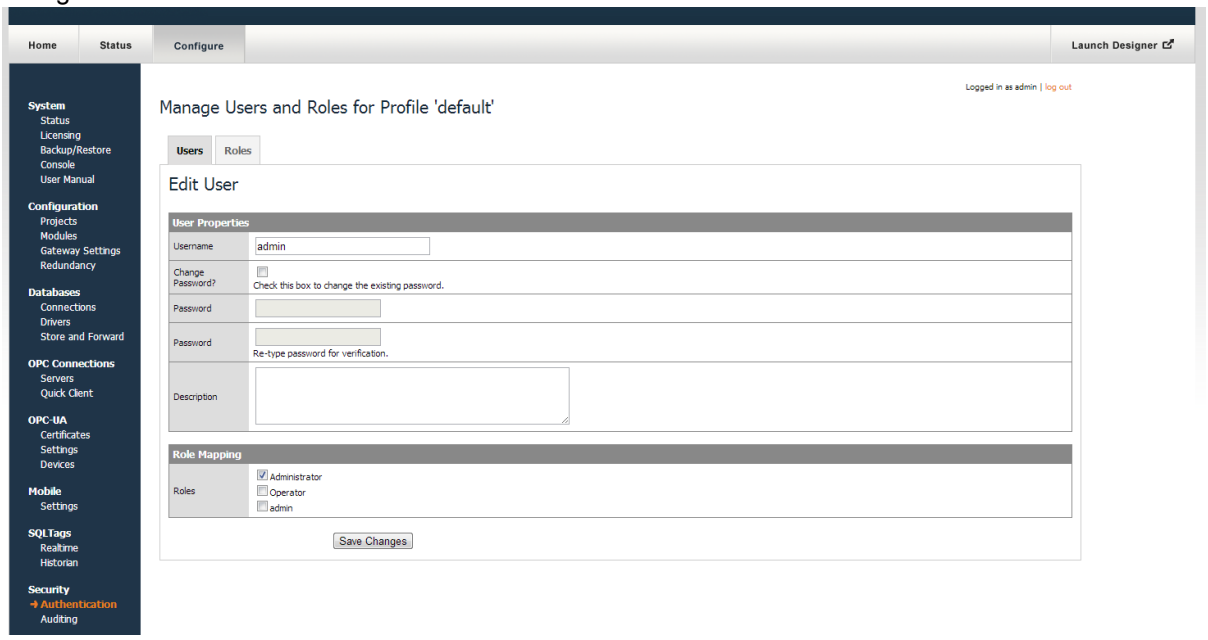
modify roles and passwords for existing users, remove users, and add/remove roles from the user source. Choosing to edit a user will bring you to the following page allowing you to make any necessary changes to that user.



Types of user sources

Internal user source - This is a simple to setup, internally managed user source. All information in this type of profile is stored in the internal database used by Ignition. These types of profiles can only be managed from the Ignition Gateway, so they are not ideal for situations where you wish to create an user source that is modifiable at project runtime.
Database user source - All roles, users, and passwords are stored in a database that you specify. Managing users is done via direct interaction with the database so this kind of profile is best suited for managing users and roles during your project at runtime.
Active Directory user source - Roles and users are managed by Active Directory.
AD/Internal user source - Users managed by Active Directory and roles stored internally.
AD/Database user source - Users managed by Active Directory and roles stored in an external database.

2.5 How do I change the default username and password?

Changing the default username and password for accessing the Ignition Gateway configuration page and the Ignition designer is a rather simple process. The easiest solution is to simply manage the users for the default user source that is set up on installation.

Steps

1. Navigate to the `Configuration > Security > Users, Roles` of the Gateway
2. Click "manage users" next to the *default* user source.
3. Select "Create new User", enter a new user name and password, then select the "Administrator" role and click "Create New User"

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These three steps will add a new user to the default internal user source and you will now be able to use that username and password to log in to the Gateway Configuration section and Ignition Designer. To learn more about the Security settings in Ignition take a look at the following user manual sections:

Security Overview
How do I control who logs into a project?
Project General Properties - The security section explains how you choose the user source for a project and specify roles needed to log in to a project.

2.6 How do I connect to a database?

Ignition is able to connect to many different types of databases so that you can store and access data from your Ignition projects, but it is not itself a database. There are many different third party software packages that provide database solutions, some of the most popular being MySQL, MS SQL Server, and Oracle. Ignition connects to these databases using JDBC drivers that are unique to each database. Drivers for the most popular databases are included so there is usually no need to install the JDBC driver manually.

It is important to note that Ignition does not install any database. It is your job to choose the database solution that is best for you and then install it either on the server that Ignition resides on or a server that can be reached over the network from the Ignition server.

Connecting to a database

The process for creating a database connection in Ignition is the same for all databases. The only place the process differs is in the connection properties. Information regarding creating a new database connection can be found here: Creating and Editing Connections. See the two guides below for a more detailed walkthrough on connecting to two of the most popular databases used with Ignition.

Guides

Connecting to MySQL - MySQL is extremely easy to connect to and should give you little problem.
Connecting to Microsoft SQL Server - MS SQL Server can be a bit more complicated to get a valid connection going, but this guide gives you step by step directions for getting connected that should make the process much easier.

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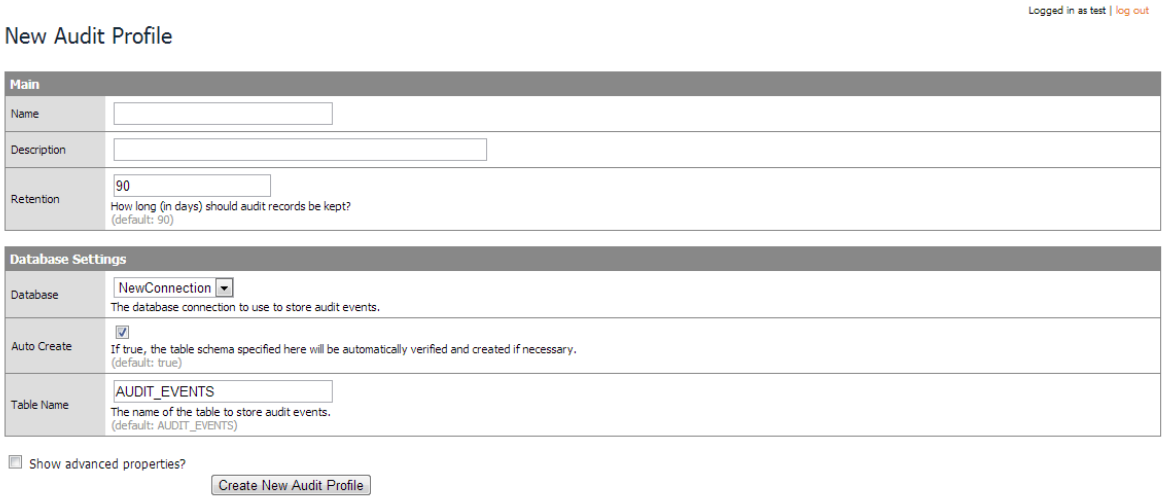
2.7 How do I enable auditing?

Enabling auditing is a simple process in Ignition. As long as you have a database connection already established (see How do I connect to a database?) all you have to do is merely create an audit profile in the Ignition Gateway.

Steps

1. Navigate to the `Configure > Security > Auditing` section of the Gateway.
2. Select "Create new Audit Profile" and then click the "Next" button on the following window.
3. Configure your audit profile settings:



Name - A unique name for your profile
Description - An optional description for you profile
Retention - The number of days you want your auditing records to be kept
Database - The database connection in which you want the audit profile stored
Auto Create - Will create the database table necessary for the audit profile automatically. If not selected then you will have to create the table in the database manually with all of the necessary columns that are specified in the "Show advanced properties" section.
Table Name - The name of the table you want the audit records to be stored to
Show advanced properties - Enabling this will display a list of all the columns that are needed for the audit profile. You can change the names of the columns if you prefer.

4. Click the "Create New Audit Profile" button

If you enabled the "Auto Create" option your table may not appear in your database right away. The table is only created the first time it is needed and can't be found, so the first audit worthy action that occurs (e.g. logging in to a project) will cause the table to be created.

2.8 How do I call a stored procedure?

Ignition has two different ways for you to make use of stored procedures within your database: transaction groups, scripting functions. Depending on your specific needs will determine which method you use to call your stored procedures.

You will want to read up on transaction groups and how they generally function if you are not very

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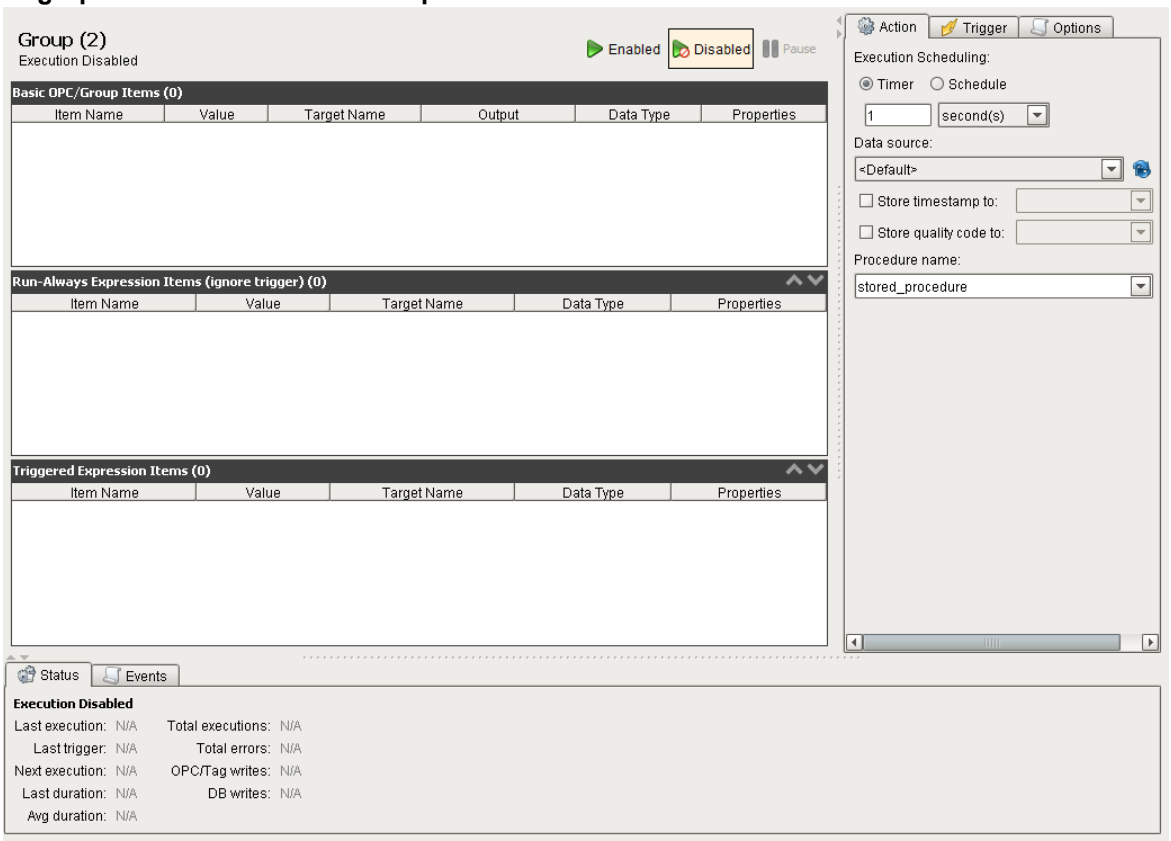
familiar with them:
General Overview - Introduction, Execution Cycle
Group Anatomy - Action Settings, Trigger and Handshake Settings, Advanced Settings
Group Items - Overview, OPC Item,

Stored Procedure Transaction Groups

Stored procedure groups allow you to target stored procedures in your database as opposed to tables, allowing you to map input and output params directly to your PLC tags. The stored procedure group is set up in much of the same way as all the other types of transaction groups in Ignition, so if you are familiar with how to use standard or historical groups then you should have no real difficulty setting up a stored procedure group. A more detailed description of the stored procedure group can be found here: Stored Procedure Group.

Setting Up a Stored Procedure Group



1. In the Ignition designer right click the Transaction Groups icon in the project browser then select "New Transaction Group" -> "New Stored Procedure Group"
2. From the dropdown box choose the data source in which your stored procedure resides. (If you have not yet made a connection to the database that contains your stored procedure see: How do I connect to a database?)
3. Once you have selected the data source, the "Procedure name" dropdown should populate with the names of any stored procedures in your database. Select which procedure you would like to

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use. If your stored procedures aren't listed and you are sure that you have selected the correct data source then simply type the name of the stored procedure in the dropdown box (case sensitive).

4. Drag in the OPC tags you want your group to use and then assign the to an input param (Target Name) or/and output param (Output) of your stored procedure. The names of your procedure parameters should show up in the dropdown boxes for the Target Name and Output columns, however if they do not show up then just specify the name of the parameter you want to reference omitting any special characters (e.g. @)
5. Configure any trigger settings you may wish to set up (Trigger and Handshake Settings), and configure and settings in the Options section (Advanced Settings)
6. Enable the group and save your project.

It is important to note that not all databases will browse correctly and list your stored procedures and their in/out parameters. Usually just entering the name of the stored procedure or parameter will be sufficient, however there are times when the database will still return an error complaining about not being able to find the correct parameter even after you have entered it exactly as it appears in the stored procedure. In these situations you will usually have to refer to the parameters by their index (usually starting at 0). The index of the parameter corresponds to its position relative to the other procedure parameters when it is declared.

Troubleshooting Group Execution Errors
Remember that the Events tab is a helpful tool for troubleshooting problems with your group execution. Error messages will be displayed under this section and double clicking the different messages will present you with a pop-up that contains more detailed information about the error that occurred. You can usually get a good idea about what exactly is causing your group to throw an error.

Scripting Functions

Ignition has several built in scripting functions that allow you to call stored procedures from event scripts in you project. The process for using these functions is similar to that described in the How do I run a SQL Query from a button? section. A summation of the general steps for using the scripting functions is as follows:

1. Create the *call context* by calling system.db.createSProcCall
2. Register any In/Out/Return Params
3. Execute the *call context* by calling system.db.execSProcCall
4. Use the appropriate *call context* functions to retrieve any output params, a return value or a resultset generated by the stored procedure

The section for system.db.createSProcCall contains some detailed examples on how to use both the create and exec functions so be sure to read through those thoroughly.

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Overview

Part III

3 Overview

3.1 What is Ignition?

Ignition is an *Industrial Application Server*. Installed as server software, it uses webpages and web-launching to create a wide variety of industrial applications. These sorts of applications typically fall under the definitions of HMI, SCADA, and MES applications. Ignition achieves its functionality through a modular architecture, meaning that multiple pieces work together seamlessly to provide features like:

OPC-UA Server
OPC-UA the leading industrial standard for data access. Using the OPC-UA Module, Ignition will act as an OPC-UA server, serving data collected by its built in drivers to other Ignition modules, as well as third-party OPC-UA clients.

For more information about OPC, see the section *What is OPC?*

Data Logger
Ignition offers robust data-logging functionality. The SQL Bridge module offers historical logging, trigger based transactions with handshakes, and much more. Additionally, the ground-breaking *SQLTags Historian* feature makes it easier than ever to store and use historical process data.

Status & Control
Ignition offer first class status and control functionality, and can be used to create single-user terminals as well as distributed systems. *SQLTags,* Ignition's tag system, provides many powerful features and unparalleled ease of use. By simply dragging-and-dropping, you can create a powerful status and control screen in minutes.

Web-Launched Clients
Client application screens are designed using a WYSIWYG designer, and then deployed to any number of client computers without installation or licensing hassles. Our powerful GUI

Alarming Server
A powerful alarming system is built into Ignition. Dynamic alarm configuration is available for each tag. A powerful alarm notification pipeline system allows for precise control over notification logic. Messages can use email, SMS, or phone calls to be sure to reach the right person when something goes wrong. A built-in alarm journal stores the history of the alarm system to a database, making it easy to track and analyze common problems in your process.

Data Analysis
Ignition offers industry-leading trending and data analysis functionality. The power of SQL database access is built in from the ground up, and offers a tremendous amount of power in today's IT centric plants. Powerful charting, tables, and reports combined with Ignition no-install, web-launched distribution model offer new possibilities in data analysis.

PDF Reporting
Create dynamic, data-rich PDF reports using the Reporting module. Leveraging the power of SQL databases, it's easy to tie together production and business data.

Fault Tolerance
Two Ignition Gateways maybe connected together using the Redundancy feature to create a fault tolerant system for mission critical applications.

See Also:
Modules

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3.2 Architecture

3.2.1 Architecture Overview

Ignition is a powerful server application that consists of many parts. However, it is designed to be approachable and easy to start using up front, with the power to accomplish many advanced tasks as the user requires them.

In order to effectively use this guide and to get started, there are a few basic concepts about the architecture of Ignition that should be understood from the start. These key concepts are located in the *System Concepts* chapter.

In addition to the internal architecture of Ignition, there are many *system architectures* that are possible. This is how Ignition is installed, and how it interacts with other key systems, such as Databases and OPC servers. The *Architecture Diagrams* chapter outlines a variety of different possibilities. Most users will begin working with Ignition using a standard architecture, where the software and all components are all installed on a single machine. To receive the full benefit of Ignition, however, it's important to know what is possible- and therefore it is recommended that you at least browse through the various architecture diagrams and advanced architecture topics. As your system expands, you can come back to investigate the possibilities in more depth.

3.2.2 System Concepts

3.2.2.1 Ignition Gateway

The Ignition gateway is the primary service that drives everything. It is a single application that runs an embedded web server, connects to data, executes modules, communicates with clients and more.

Starting and Stopping the Gateway

After installation, the gateway will be started automatically. Manually stopping and starting the service will depend on the platform that you are using.

Windows

Access the service control utility through `Control Panel>Administrative Tools>Services`. The "Ignition" service entry can be used to control the run state of the gateway.

Linux

It is possible to control the service through the *Ignition.sh* script. It can be called with the `start` and `stop` parameters to perform the relevant operations.

For example:

```
>./Ignition.sh start
```

Access the Gateway

To monitor and configure the gateway, you will use a web browser to connect to the web server operated by Ignition. See the Gateway Navigation section for information about how to connect, and a description of the gateway.

Gateway Control Utility

The Gateway Control Utility is an application that can be used to monitor the gateway and perform high-level tasks that aren't available inside of the web application. The GCU can be found from the Start menu in windows and in the install directory in other platforms. See Gateway Control Utility under the Basic

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Usage chapter for more information.

3.2.2.2 Ignition Designer

The Ignition Designer is a web-launched application that lets you configure and build your projects. The application is launched from the gateway homepage. See Gateway Navigation for more information.

Project structure and the designer

The Ignition gateway runs projects, and it is possible to create any number of projects. Each project consists of settings and *project resources*, objects that are defined by modules.

When the designer is opened, you will be asked to select or create a project. The designer will then display one or more *workspaces* according to the modules that are installed, and you will be able to create and modify different types of project resources. When the project is saved, the modifications are sent to the gateway, where they are handled by the appropriate modules.

Working concurrently on projects

It is possible for multiple designers to operate on the same project concurrently. This situation is common in large projects where multiple people may be involved. When a particular resource is being edited, it will be *locked*, and the other designers won't be able to edit it. When the project is saved, the resource will be unlocked.

Concurrent edits will be received by other designers only when "Update Project" is clicked from the file menu.

3.2.2.3 Ignition Vision Clients

The web-launched Vision Clients are the "runtimes" of the Vision module. They run as full applications and feel like a traditional installed client, without the need to install and manually synchronize projects.

Launching clients

Clients are launched from the Gateway homepage, for a specific project. See the Gateway Navigation section for more information.

Updating client projects

Clients are automatically notified when project updates are available. When launching a client, the most recent version of the project will always be used. If an update occurs while a client is open, a bar will appear across the top of the client, notifying the user. By clicking on the bar, the new project modifications will be downloaded and applied. You can also configure a client to use *Push* notification, which means that the new version will be downloaded and applied automatically.

3.2.2.4 Mobile Clients

With the Mobile Module installed, you can launch your same Vision projects on any modern smartphone or tablet. This ability does not require any re-design of your projects - a mobile client launches the same projects that the Vision clients launch.

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How it works

Normally, you can't launch Vision Module projects on mobile devices. This is due to the technical limitation that Java SE (Standard Edition) does not run on mobile devices. The Mobile Module gets around this limitation by launching the client on the Gateway in a special *headless* (invisible) mode, and then using HTML5 and AJAX to show the client's screen on the mobile device's browser.

Networking

Typically, the mobile device will connect to the Ignition Gateway via the facility's wireless LAN (802.11) infrastructure. To launch a mobile client, the mobile device simply connects to the Ignition Gateway by pointing its web browser to the Gateway's LAN address. It is important to understand that normally, the traffic is not going over the device's cellular connection. This wouldn't work, because the cellular connection connects to the internet, and without explicit setup, an Ignition Gateway is not accessible from the outside internet.

Remote (as in, beyond the reach of 802.11 wireless LAN) mobile access can be enabled through the same networking strategies that enable remote access for standard Vision clients. Somehow, the mobile device must be able to access the Ignition Gateway via its cellular connection. One strategy would be to set up a VPN router and configure the mobile device as a VPN client. This way, the mobile device could directly access the LAN address of the Gateway as if it were on-site. Another technique would be to put the Ignition Gateway in a DMZ so that at least one NIC had a public IP address. Or, an edge router could be configured to port-forward the HTTP and HTTPS ports to the Gateway. Coordination with your I.T. department would be advised when attempting to set up remote access.

3.2.2.5 Database Access

Access to relational databases is at the heart of the Ignition platform. Ignition can connect to any SQL database that has a JDBC driver, though depending on the database's capabilities, some features may not be available.

Why use Databases?

Ignition can perform many tasks without the use of a database. For instance, the Vision and OPC-UA modules can be used to create powerful HMI status and control screens, SQLTags can be used to generate alarms that can be sent over email, and more. However, tightly integrated database access is a key feature that makes Ignition stand out from its competitors.

Modern relational databases offer amazing storage and querying capabilities with great performance at a price that is incomparable to older legacy historians. While it is true that historians still have a place in the industry, for most applications relational SQL databases not only suffice, but offer much more than what was previously available. Using SQL, you can store and track production information with ease. However, you can also correlate that data to who was on shift, previous runs, downtime, inventory levels and more, naturally and easily. Make the data available to more people using the Vision module's web-launch clients, or integrate the data directly into your company's internal or external website. SQL databases are at the heart of the web and modern corporate IT systems, and now thanks to Ignition, the plant floor as well.

Configuring Database Access

See the Database section under Gateway Configuration for more information about connecting to databases through Ignition.

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3.2.2.6 OPC-UA

OPC-UA is the latest revision of the OPC specification, which offers platform and vendor neutral transfer and use of industrial data. The specification plays a crucial role in Ignition, and is the primary data access specification used in the Gateway. Ignition supports connections to any number of OPC-UA servers created by any manufacturer, provided that they are compliant to the specification. The data is then used to drive all aspects of the system. Creating connections to OPC-UA servers is described in the Gateway Configuration section.

Creating Distributed Systems with OPC-UA

OPC-UA breaks down boundaries and enables free data flow. Using standard TCP/IP instead of legacy DCOM, OPC-UA makes it easy to securely transfer data between networks and though firewalls. All OPC-UA connections are based on the same technology, which means that a connection to your local machine is not entirely different than a connection to a machine that's far away. This enables the creation of highly distributed system, and in combination with other features of Ignition can lead to much more connected enterprises.

For example, imagine a corporate network with an office in the center, and remote processes connected through a VPN, which would pass through a variety of connections. Each remote site could have an Ignition installation running only an OPC-UA module that would report data back to a central facility and record it in a database. The overall system cost would be very low, the data could be managed centrally in a single location, and then made available to all interested parties through the Vision module or any application that could access the database.

3.2.2.7 SQLTags

Introduction

SQLTags™ is the tag database mechanism of Ignition. Each tag in Ignition is a SQLTag, irregardless of whether the value comes from OPC, an expression, or is static. SQLTags provide a variety of configuration options, such as alarming, scaling, and historical storage.

SQLTags are stored in *tag providers*. By default, a fresh Ignition installation will have an *internal* tag provider - this can be thought of as a standard internal tag database. Additionally, it is possible create *external* DB-based tag providers, thus turning your SQL database into the tag database. This ability opens up some very flexible architectures and is the primary reason why SQLTags have their name.

Main benefits of SQLTags

SQLTags work naturally with Ignition to offer many exciting features:

Drag and Drop screen design
Using the Vision module, drag and drop tags onto a window to automatically create new bound components. Drag tags onto existing components or properties to quickly bind them to the data. Creating powerful status and control screens is literally just clicks away!

Object-Oriented Design
Use SQLTag UDTs (user-defined data types) to design re-usable, parameterized, and extendable data types. New instance tags can be created and configured in seconds, potentially saving a tremendous amount of time over traditional tag systems.

Performance and Scalability
SQLTags offer terrific performance on both the gateway and client side. On the gateway side, the

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system can support thousands of value changes per second, and hundreds of thousands of tags overall. On the client side, SQLTags improve efficiency with their lightweight subscription architecture. Adding additional clients creates a nearly negligible effect on the database and gateway performance.

Integrated component feedback
SQLTags feature a *quality* and *overlay* system for Vision module components. If a tag's data quality is anything but good, a component that depends on it will get a visual overlay. Input components display an animated overlay while write pending requests are being written. These features effectively communicate the status of the system at a glance.

One-click historical logging with SQLTags Historian™
SQLTags Historian makes it easier than ever to store and use historical data. By simply selecting a checkbox on a tag, historical data will be stored in an efficient format in your SQL database, and will be available for querying through scripting, historical bindings and reporting. Drag-and-drop tags directly onto an EasyChart™ to create trends, or onto a table to display historical values. SQLTags Historian's robust querying features give you great flexibility in how you retrieve the data.

Powerful Alarming Model
Each tag can have any number of alarms configured on it. There are many different alarm modes accommodating simple digital alarms, analog high/low value alarms, as well as more specialty alarms like bad data quality and bit-packed alarms. The settings for alarms may be bound to other tags, making the alarm configuration dynamic. You can attach associated data to alarms to turn the alarm journal into a forensic tool to help determine the state of your process when issues occurred.

Getting started with SQLTags

See the SQLTags section under Project Design for more information about creating and using SQLTags and SQLTags Historian.

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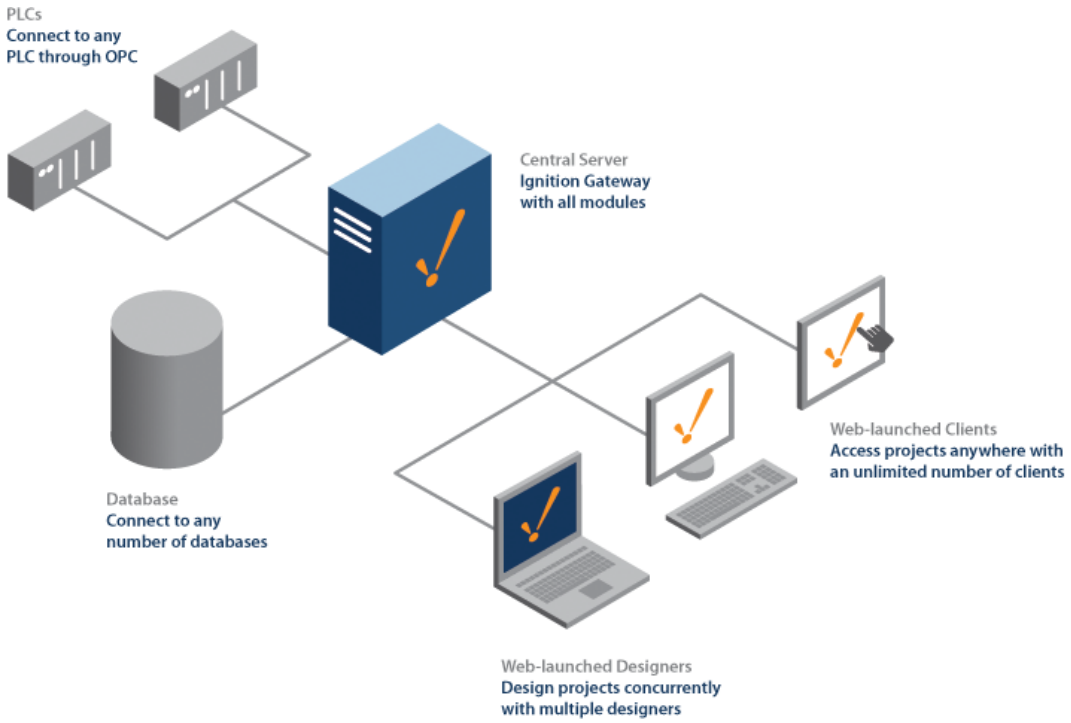
3.2.3 Architecture Diagrams

3.2.3.1 Standard Architecture



In the standard architecture, a single Ignition gateway is installed on a central server with all of the desired modules. Devices are connected over the network or serial links, and are accessed through Ignition OPC-UA or other OPC servers installed on the same machine. Database connections are made to database servers installed on the same machine or elsewhere on the network.

Any network enabled device with Java and access to the server can launch clients by going to the gateway homepage. Designers can also be launched over the network. Both clients and designers can be launched locally at the server as well.

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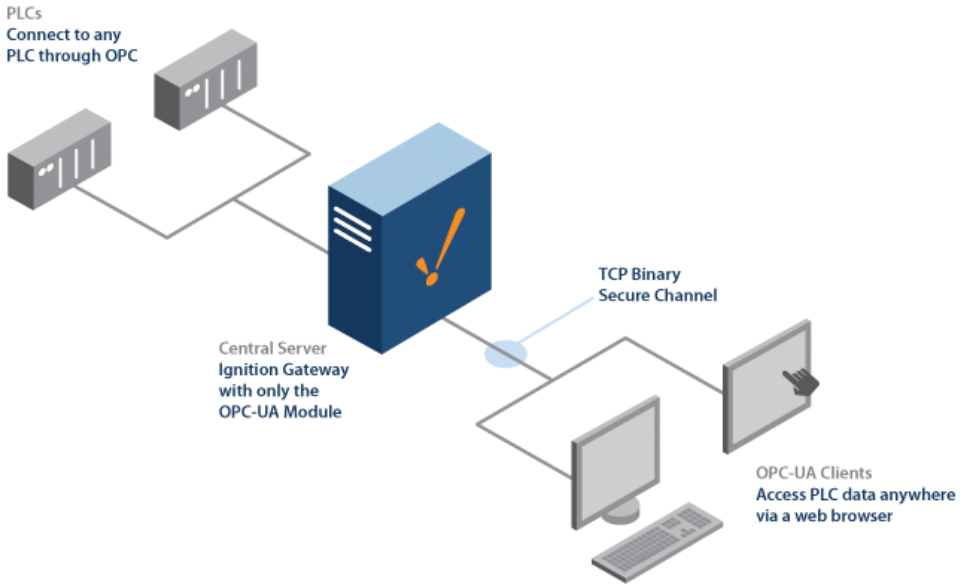
3.2.3.2 OPC-UA Architecture



The OPC-UA architecture is very similar to the Standard architecture, but with only the Ignition OPC-UA module installed on the server. In this configuration, the Ignition gateway acts as a dedicated OPC-UA server. Any remote OPC-UA client, including other Ignition gateways, with network access can connect to the server and read and write data.

This installation is useful for aggregating data from many sites. The low installation cost and the secure, painless connections provided by OPC-UA make it easy to access and collect data that wasn't previously available on the network.

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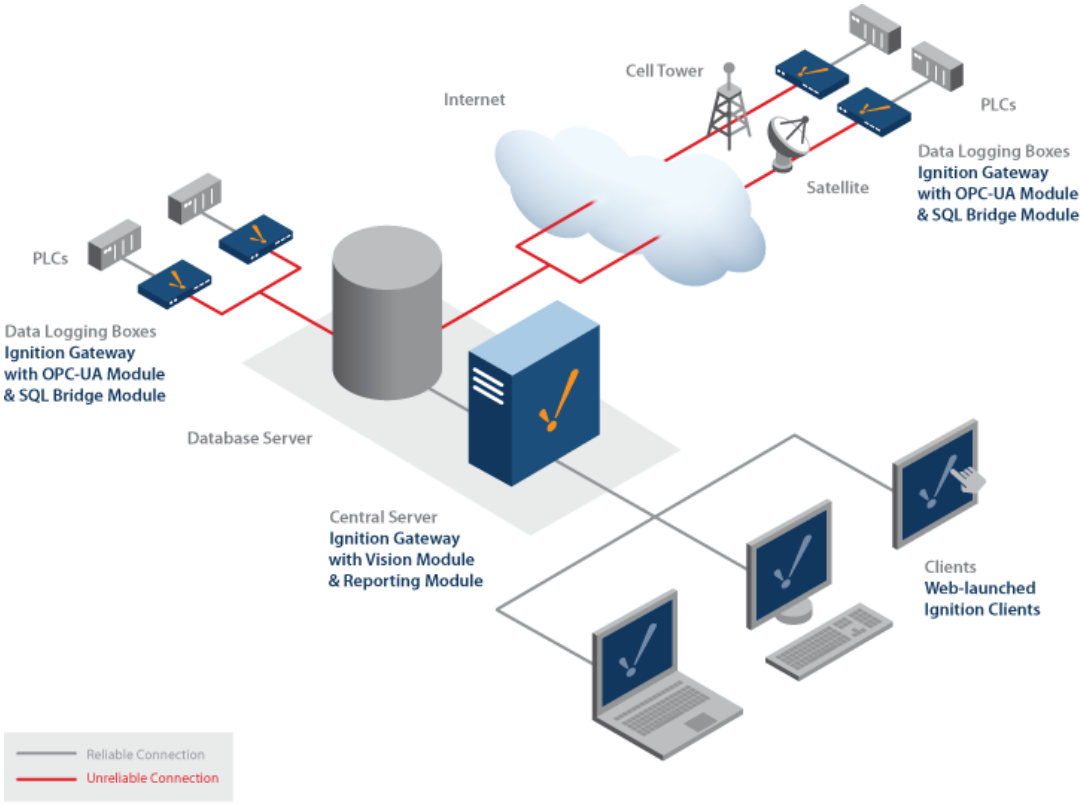
3.2.3.3 Remote Datalogging Architecture



Ignition is highly network centric, with the ability to connect to remote databases and OPC-UA servers as naturally as to local ones. This fact, combined with the built-in *store & forward engine,* make it possible to create wide, geographically dispersed systems with little additional work.

Remote Ignition gateways with the OPC-UA and SQL Bridge modules can store data to central servers. Should the connection go down, the data will be cached until the connection is again available, ensuring that nothing is lost.

Web-launched clients can be used on any computer with access to the network- even over a WAN (wide area network) or VPN (virtual private network). In this way, users can securely access data that has been pulled together from a wide variety of sources.

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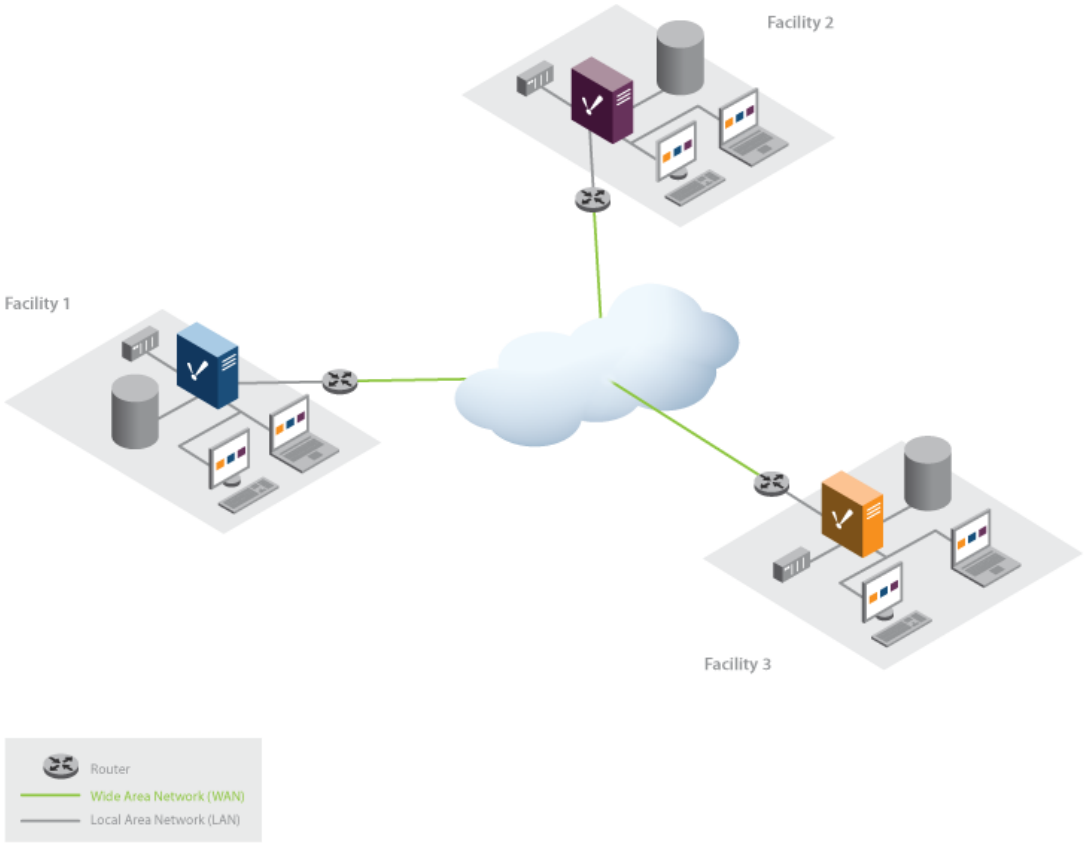
3.2.3.4 Wide-area SCADA Architecture



As described in the Remote Datalogging section, the network-centric nature of Ignition makes it easy to access data across a wide area network. Additional key features such as *retargeting* make it possible to blend complete systems hosted at different locations into one seamless architecture.

Each location operates independently, but when combined with a secure inter-location network (such as a VPN over the internet), any location can securely interact with the other locations. There are many possible layers of security, included encrypted communication and the ability to adjust authentication access for each location. For example, users from remote sites may be allowed to only view data, and not modify or control machinery. Conversely, if desired, a central operator may be allowed to control aspects of each location.

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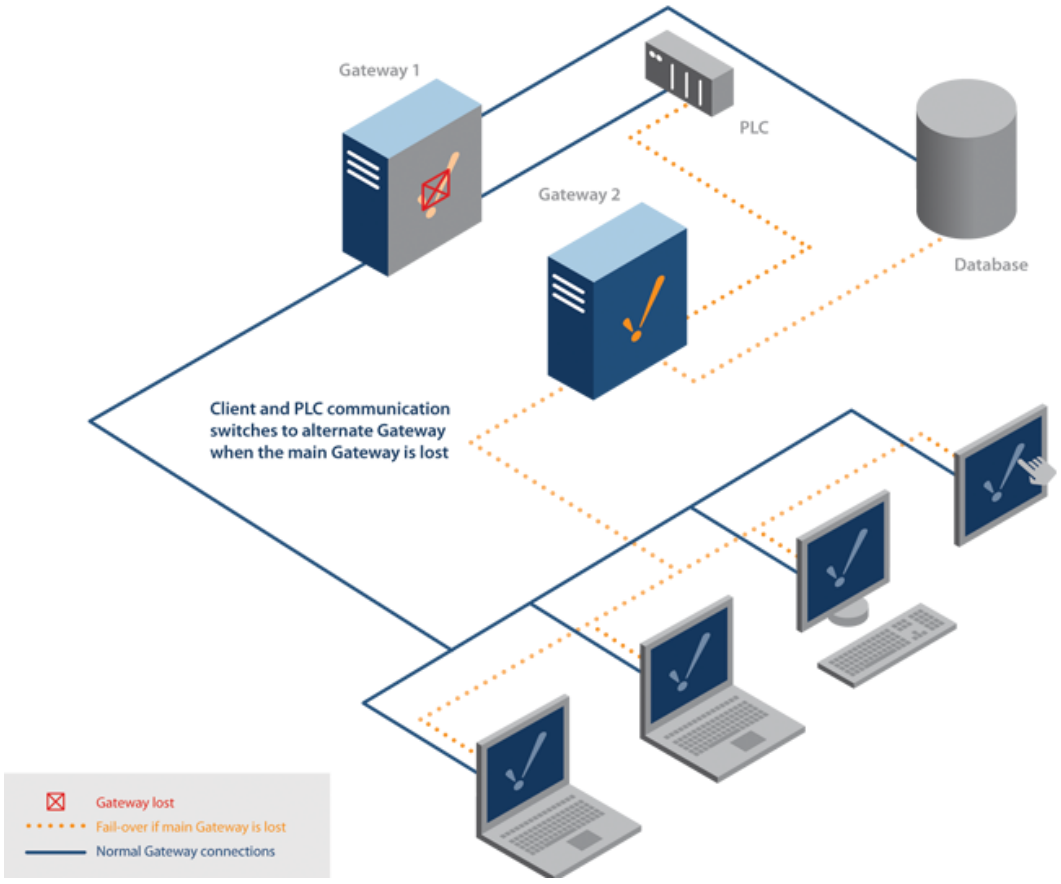
3.2.3.5 Mission Critical Architecture



Two Ignition Gateways can connect together in a fault-tolerant master/backup configuration, enabling redundancy that protects against server hardware failure. If the master gateway fails, the backup will take over and continue executing. All connected clients will be redirected to the backup machine automatically, and historical data logging will continue with minimal interruption.

After the master is restored, the switch back to the master can be configured to be automatic or require a manual command to be issued.

3.2.4 Advanced Architecture Topics

3.2.4.1 Remote Logging

The network-centric nature of Ignition offer a large amount of flexibility for building highly distributed systems. One common task is to gather data from remote sites and record it centrally, for easy sharing and additional analysis. There are several ways to accomplish this in Ignition.

OPC-UA Only

OPC-UA is a network-based specification, and is ideal for collecting data from remote locations. Installing Ignition with only the OPC-UA gives you the ability to connect easily and securely from any number of other Ignition installations, or with other OPC-UA clients.

This method only exposes data, however, and the client side must then record it if historical data is

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desired. If the connection goes down, data will not be available. This method offers the lowest cost, and is suited for situations where the data is not highly critical or historical- for example, remote realtime monitoring.

Remote SQL Bridge

By installing the SQL Bridge module in the remote gateway, you benefit from the *store & forward system* to ensure that no historical data is lost. The system may still be access through OPC-UA as outlined above, or database-based SQLTags may be used to communicate current status. By doing this, it is possible to use SQLTags Historian and alarming, both of which utilize the store & forward system to avoid data loss. This method is ideal for historical data.

3.2.4.2 Distributed SQLTags

SQLTags offer a number of different configuration options. By default, SQLTags are driven by Ignition and stored internally. However, using the Database SQLTags provider, it is possible to store SQLTag configuration and values in an external database. This database can hold tags from multiple Ignition gateways, and each of those gateways will be able to access the tags driven by the others.

Using this methodology it is possible to aggregate multiple remote sites and built a cohesive system that spans multiple parts of a single plant, or multiple separate plants entirely.

3.2.4.3 Client Retargeting

Client Retargeting is the method by which Clients running a particular project switch to a different project on the fly, even if the other project is hosted on a different Ignition Gateway.

Retargeting is a key feature used to build distributed systems. It allows you switch between projects and servers as easily as switching between windows. Using Retargeting, even geographically dispersed projects can be presented as a single cohesive unit.

Using Retargeting

Retargeting is accomplished through scripting, usually as a response to a button press or other component event. The `system.util.retarget` function allows you to specify a Gateway and project to retarget to. Authentication will be transferred with the request, and the switch will only occur if the current user also has rights to the target project.

3.3 Modules

3.3.1 Overview

What are modules?

Modules are applications that are built on the Ignition platform and integrate into the platform in order to offer functionality. Most of the main features of Ignition are actually provided by different modules such as the Vision and SQL Bridge modules.

Modules integrate seamlessly into the system and provide things like new designer workspaces, new gateway settings, new drivers, and much more.

Why Modules?

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The modular architecture of Ignition offers a wide array of benefits.

Flexible licensing - only license the modules that you need, saving money and reducing complexity compared to big monolithic applications that try to do everything. At the same time, the modules have been designed to offer a broad swath of functionality, to avoid having too many pieces.

Hot-swappable - Modules can be dynamically loaded and unloaded, allowing you to install, remove and upgrade them without affecting other parts of the system. This can have huge implications for big projects where up-time is important.

Increased system stability - Building modules on a common platform means fewer bugs, better isolation, and all around increased stability.

3.3.2 OPC-UA Module

The Ignition OPC-UA module offers OPC-UA server functionality with a variety of device drivers and a robust, open driver API.

OPC-UA Server Functionality

This module turns Ignition into an OPC-UA server, capable of handling connections from any OPC-UA compatible client. Outgoing connections can also be made to 3rd party OPC-UA servers. In this way Ignition functions as both an OPC-UA server and an OPC-UA client.

Built-in Device Drivers

The OPC-UA module offers a number of device drivers for common protocols out-of-the box, and is easily expandable thanks to the hot-swappable module architecture in Ignition. New drivers can be downloaded and installed in minutes without requiring a system restart or otherwise affecting other parts of the Ignition platform.

Redundancy Support

The OPC-UA module ties into the Ignition redundancy in order to provide efficient access to device data along with failover redundancy, with no additional configuration.

Public Driver API

Anyone can create new drivers thanks to the open driver API, and users can download and install drivers created by other developers. This is the first time such an API has been made publicly available for a product like Ignition. For more information about creating drivers for Ignition, visit the Inductive Automation website.

3.3.3 SQL Bridge Module

The SQL Bridge module is a robust and flexible tool to map between OPC data and Database data. Different types of Transaction Groups allow you to configure a variety of behaviors, from trigger based historical logging, to bi-directional synchronization, to recipe management and more.

Services provided by the SQL Bridge Module

Multiple types of Transaction Groups that offer:

- Historical logging
- Status updating

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- Transactional logging
- DB-to-OPC synchronization
- Stored procedure support

Easy configuration using the web-launched designer

SQLTags Historian

External SQLTags driving

See also:
Transaction Group Overview

3.3.4 Vision Module

The Vision module provides the visual elements of Ignition. Vision offers a wide range of functionality, and can be used to create HMI style control systems, data analysis and trending applications, executive dashboards, and more. The projects are designed using the Ignition Designer, and clients are web-launched with zero installation from any Java capable computer.

Create your ideal control system in minutes

Combined with the power of SQLTags, it's never been easier to build effective status and control systems. Drag and drop tags on the screen to create automatically bound buttons, HOA toggles, LED displays, value entry fields, and more. Drag tags directly onto component properties to bind bi-directionally in seconds. The innovative *overlay system* provides intuitive data quality feedback with no additional configuration.

Vector graphics

Powerful vector-graphics drawing tools allow you to create inviting graphics for your project. Vector graphics are screen-resolution independent, allowing screens to look great on any size monitor. Advanced graphics features like gradients, Bézier curves, transparency, are easily accessible with the intuitive drawing tools. Create your own symbols, import them from *.svg files using drag-and-drop, or use the Symbol Factory module to access nearly 4,000 ready to use, professional-quality vector symbols.

World-class charting capabilities

The Ignition Vision module offers a variety of charting and trending options. The *Easy Chart*, as its name suggests, makes it incredibly easy to create useful and powerful charts. The charts support multiple axes, sub-plots, many pens, and hundreds of thousands of data points. Using SQLTags Historian, creating charts is as simple as drag-and-drop, and charts intelligently pull just the data they need, making clients more efficient.

Integrated database connectivity

The Ignition Vision module is the world's most database friendly HMI/SCADA application. Working with SQL databases is integrated into many aspects of the project design process, allowing you to integrate process and business data effortlessly.

Unlimited potential

Web-launched clients, the ability to seamlessly connect multiple projects through Retargeting, and no licensing restrictions on screens, tags, components or clients means the system can grow over time.

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3.3.5 Reporting Module

The reporting module adds dynamic reporting functionality to the Vision module, allowing you to display reports to Vision clients or to generate PDF files.

The reporting module offers flexible report generation, with a variety of components, charts and tables. Additionally, it supports the import of existing forms and images, allowing you to migrate from paper based tracking systems to an electronic system.

3.3.6 Mobile Module

The Mobile Module adds the ability to launch Vision Module projects on modern smartphones. This lets you keep track of your control system while moving around your facility. The Mobile Module can be combined with remote-access networking architecture to allow global on-the-go access to your control system.

3.3.7 Alarm Notification Module

The alarm notification module (introduced for Ignition version 7.6.0) adds the ability to send out notification messages when alarms go active and when they clear. This module provides the functionality outlined below, and then other modules can extend it to provide additional notification capabilities, like phone support.

Notification Pipelines

Alarm notification pipelines are logic diagrams that control how alarm notifications are sent out, including who they are sent to and when. They can be used to achieve many advanced alarming scenarios, such as delays, escalation, and parallel delivery. They are designed using a drag-and-drop designing interface through the Ignition Designer.

Email Notification Profile

The Alarm Notification Module includes the ability to send alarm notifications via email. Users who receive these emails are also able to acknowledge the alarm by visiting a link contained in the email.

3.3.8 OPC-COM Module

The OPC-COM module gives Ignition the ability to connect to legacy ("classic") COM based OPC-DA servers. It supports OPC-DA 2.0 and 3.0.

Connecting to classic OPC servers

With the OPC-COM module installed, there will be a new option for COM based OPC servers when creating a server connection in the gateway. The OPC-COM module is primarily intended for use with local OPC servers, although it also provides basic support for remote connections.

Even when connecting locally, the application may run into the traditional difficulties of connecting to OPC servers. DCOM security settings on the machine can interfere with connections, and the OPC Core Components package must be properly installed before connections can be established.

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Using data from classic OPC servers

After a connection to a server has been defined, the server will appear along side of other OPC servers (both COM and UA based) in the OPC Tag Browser. You can use these tags like any other ones - bring them into SQLTags, use them in Transaction Groups, etc.

3.3.9 Other Modules

The pluggable module architecture allows quick integration of new modules into the Ignition platform. From time to time new modules will be release which add additional features. Third party modules that provide a wide range of functionality are also available.

Driver modules

Drivers for the OPC-UA module are deployed as modules themselves. While they don't add a visible element to the system, they are loaded and upgraded in the same manner as other Ignition modules.

Symbol Factory Module

This module integrates Symbol Factory 2.5 from Software Toolbox into the Ignition Designer. The intuitive interface allows you to browse and search through nearly 4,000 high quality vector graphics symbols. Once you find the symbol you're looking for, simple drag-and-drop it onto a Vision window to use it right away. Double-click on the symbol to change it, or dynamically animate parts of it to bring your project to life.

SMS Notification Module

This module adds the ability to send alarm notifications via SMS. The Alarm Notification Module is required for this module to work. The SMS messages are sent through an Airlink Raven XE modem, which must be purchased separately.

Voice Notification Module

This module adds the ability to send alarm notifications as a phone call. It uses an advanced text-to-speech library to turn the alarm message into audio. The phone call is mode using SIP, a VoIP (Voice over Internet Protocol) technology. If you do not have an available VoIP server on-premise, a Skype Connect connection can be made, or a plain telephone line can be used by purchasing a product such as the Atcom IP01 phone gateway.

3.4 Basic Usage

3.4.1 Gateway Navigation

Accessing the Gateway

The Ignition Gateway is accessed via a web browser. The web browser can be running on any machine that has network access to the host that is running the Ignition Gateway. By default, Ignition installs using **port 8088**.

Example

If the host's IP address was 10.0.28.30, you would access the Ignition Gateway via the URL:

```
http://10.0.28.30:8088
```

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Gateway Sections

Across the top of the Ignition gateway you'll find several buttons that lead to the key sections of the server.

Home

The homepage shows a quick overview of the primary modules installed. From here you can:

- Launch Vision project clients.
- View the current status of the SQL Bridge module, and how many transaction groups are running.
- View the state of your device connections under the OPC-UA module.

Status

The status portal provides in depth information about various parts of the Ignition system. There are sub-pages containing information about:

- The state of the installed modules
- The status of all DB connections, OPC Server connections, and SQLTag providers.
- The status of the store and forward engine, including performance metrics and data cache information.
- Current designer and client sessions connected to the gateway.
- Status of all the Gateway Scripts that are running in each of the different projects on the Ignition Gateway
- Information and statistics regarding the OPC-UA server.

Configure

This section is where all gateway/platform configuration is performed. See Gateway Configuration for more complete details.

In general, this is where you'll go to:

- Create new projects
- Create database connections
- Create connections to OPC servers
- Tune performance settings
- Modify SQLTags Historian data settings
- Manage users and roles and much more.

Launch Designer

This button directly launches the Ignition Designer.

3.4.2 Gateway Control Utility

The Gateway Control Utility, sometimes referred to as simply the "GCU", is a lightweight stand-alone application that can provide information about the Ignition gateway. It also provides basic administrative controls, such as stopping and restarting the server, and setting the ports used between the gateway and clients. Note that the Gateway Control Utility must run on the same machine as the Ignition gateway.

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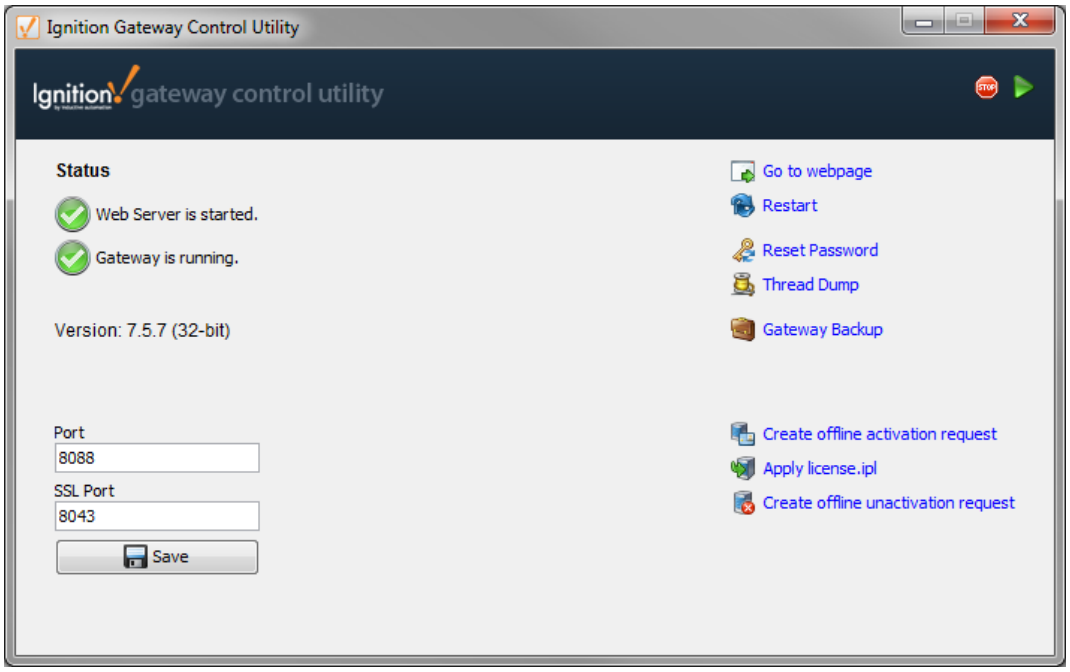

The Gateway Control Utility

Windows: The GCU can be launched from the start menu under `Programs > Inductive Automation > Ignition > Launch Gateway Control Utility`. You can also launch the GCU from either a command line or from the Start -> Run dialog by typing **`launch-gcu`**

Linux: The GCU can be launched by opening a command shell and typing **`gcu`**. If you receive an error saying that "gcu can't be found", then you need to add the Ignition installation directory to your system path. See the Installation (Linux) section for instructions. If you are running in a headless Linux environment, or you have logged into the Linux machine through an SSH shell, then the functions of the GCU are still available in command-line form. See the Command Line Utility section below.

Gateway Status

The upper left side of the screen shows the state of the Tomcat web server and the Ignition Gateway web application. It is possible for the web server to be running while the Gateway has failed. For example, this can occur when the Gateway has faulted upon startup.

Commands

The GCU provides several commands that can be run to administer the gateway:

Go to webpage
Launches a web browser to the gateway home page.

Restart
Restarts the Tomcat web server.

Reset Password
Allows you to reset the root password of the system. This is not normally considered a security risk, because the GCU can only be used from the machine the software is installed on, which should be

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secure. However, it is important to know that this function is here, so that the GCU can be removed if the machine can't be properly secured (for example, when the server is also used as a client).

Thread dump
Downloads a file with the current states of all threads in the server, used by Inductive Automation for troubleshooting problems.

Gateway Backup
Downloads a Gateway backup (.gwbk) file to the local file system. A Save File dialog will open, allowing you to specify where to save the .gwbk file.

Create offline activation request
Creates a license activation_request.txt file that you can use to request a license.ipl file from the Inductive Automation website (see the Offline Activation section for more details). You will be prompted to enter a CD-key to create the activation file. Use this function only if online activation through the Internet is not available.

Apply license.ipl
Applies a license.ipl file that was downloaded from the Inductive Automation website. An Open File dialog will open, allowing you to select the license.ipl file to use.

Create offline unactivation request
Creates an unactivate_message.txt file that you can use to unactivate a license via the Inductive Automation website (see the Unactivation section for more details). Use this function only if online unactivation through the Internet is not available. Also, the Gateway returns to trial mode immediately after the unactivate_message.txt file is generated. It is not possible to unactivate a Gateway again after it is already been unactivated once. Do not lose the unactivate_message.txt file until after it has been used on the Inductive Automation website!

Port
Sets the primary, non-encrypted port used by clients to communicate with the server. Click the Save button to apply the port change to the gateway. The gateway must be restarted for the change to take effect.

SSL Port
Sets the port that will be used by clients for SSL communication. Click the Save button to apply the port change to the gateway. The gateway must be restarted for the change to take effect.

Stop Service and Start Service
Windows users get two additional buttons at the top. The stop button stops the Ignition Windows service, and the start button starts the Ignition Windows service. Linux users can stop and start the gateway with these command-line commands:

```
/etc/init.d/ignition start
/etc/init.d/ignition stop
```

Command Line Utility

All the functions in the GCU are also available as a command line utility for both Windows and Linux. To run the utility, open a command shell and type in:
`gwcmd` <option>

Options are as follows:
-a,--activate <CD-key> Offline activation: creates an activation_request.txt file that can be used to request a license.ipl file from the Inductive Automation website. You must specify

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	the CD-key to use for activation. The activation_request.txt file will be saved in the current directory.
-b,--backup <new file path>	Downloads a Gateway backup (.gwbk) file and saves the file to the specified path. The path can be either an absolute path or a relative path.If a new file name is not specified at the end of the path, then the file name will become the current date and time along with the .gwbk extension. You will be prompted whether it is OK to overwrite the file if another .gwbk file with the same name already exists (override with the -y option to force the file to always be overwritten).
-h,--help	Shows the usage for this command
-i,--info	Retrieves server status and port information from the Gateway if it is running
-k,--port <new port>	Changes the Gateway http port
-l,--sslport <new port>	Changes the Gateway https port
-p,--passwd	Resets the Gateway login password
-r,--restart	Restarts the Gateway
-t,--tdump	Performs a thread dump in the Gateway and prints the dump to the command line
-u,--unactivate	Offline unactivation: creates an unactivation_message.txt file that can be used to unactivate a license via the Inductive Automation website. The unactivation_message.txt file will be saved in the current directory.
-w,--uselicense <license.ipl path>	Applies a license.ipl file that was downloaded from the Inductive Automation website. You must supply the location of the license.ipl file. If it is in the current directory, use **license.ipl** for the location.
-y,--promptyes	Automatically answers "yes" to any prompt that may appear in the above commands (such as permission to overwrite an existing file).

3.4.3 Web Launching

Web-launching is the mechanism by which clients and designers are opened on a machine. They are *launched* from the Ignition gateway, download and run without requiring any installation steps.

How Web-Launching Works

Web-launching relies on *Java WebStart* technology. When the user clicks on a project or designer link in the Ignition gateway (or embedded in a separate website), they download a small *JNLP* file that describes the application. When this file is opened (usually automatically), Java is invoked on the user's machine and directed to the remote application. The application is downloaded and cached, and then executed.

The running application (an Ignition client or designer) communicates with the gateway via HTTP. It is cached for increased subsequent launch speed, and can optionally install a link in the Start menu and on the desktop for easy access. By default a shortcut is created for you but this setting can be changed in the Java Control Panel.

Troubleshooting Web Launch Problems

There are a few common problems that can cause difficulties with web-launching. Fortunately, they are often easy to fix.

No Java Installed

Web-launching clients and designers requires having Java version 5 or greater installed on the client machine. The Ignition gateway will detect whether Java is installed and offer help, but users are free to download and install Java on their own. Java can be installed by visiting http://www.java.com

No Network Connection

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Web-launched clients depend on network connectivity to connect to the server. If the network is unavailable, the client cannot be launched. This is often a problem with clients and designers launched directly from desktop/start menu links.

Cached References to Modified Servers
The cached projects/launch shortcuts contain the address of the gateway machine. If the server is relocated, these links will no longer work. They can be updated by re-launching from the gateway.

3.4.4 Launching Clients

Clients are launched by going to the gateway homepage. See Gateway Navigation for more information about accessing the gateway.

There are three ways to run clients: Windowed, Full screen, and Applet. The mode can be chosen from the drop down next to the project name. Clicking on the project name will launch the project in the default mode. Certain modes may not be available, depending on project settings.

Windowed

The "Windowed" mode is the standard launch method. The client will be web-launched using Java Web-Start and will have its own window. In this mode, it will run as a full, independent application. After being launched, the browser can be closed and the project can be launched from a shortcut on the desktop.

Full Screen

The "full screen" launch mode is similar to the Windowed mode, and will also use web-launching to run the client as a full, independent application. In this mode, however, the client will occupy the full screen, and will not have a title bar. This mode is ideal for touch-screen display panels, and other displays where the Ignition project will be the sole focus on the screen.

Applet

Selecting "applet" launch mode will run the client application as an applet embedded in your web browser. Applet mode is most commonly used to integrate Vision projects into existing web sites, such as in a corporate intranet setting.

Mobile

If you have the Mobile Module installed, you can launch projects on your smartphone or tablet as well. All the user has to do to launch a mobile client is to connect their mobile device to the wireless network and point the web-browser to the Gateway's LAN address. At this point, they'll be presented with a mobile-optimized version of the Ignition Gateway homepage, where they can select a project to launch. Note that projects must have at least one window defined and be enabled for mobile launching in order to show up in this list. After selecting a project and logging in, they can use the project like a normal project. To access the mobile project context menu, press and hold on your touch-sensitive device. A circular menu will appear allowing you to switch between pointer and pan/zoom mode, as well as options for logging out and entering text input.

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3.4.5 Launching the Designer

The Designer can be launched from the Gateway homepage by clicking on the "Launch Designer" button. See Gateway Navigation for more information about accessing the Gateway.

It is possible to have multiple Designers open concurrently. Each Designer will lock the resources that it's modified, and other Designers won't be able to access them until they've been saved.

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Gateway Configuration

Part IV

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4 Gateway Configuration

4.1 Gateway Configuration Overview

The gateway is the central location where all general services are configured in Ignition. Additionally, the gateway configuration section is where operations such as backing up the system, restoring, and managing projects are performed.

The gateway configuration settings cover the following broad categories:

System Management - Licensing, Backup/Restore
Module Management
Project Management
Database Connectivity
OPC Connectivity
SQLTags
Security
Alarming

Other categories may also be available, depending on the modules installed.

4.2 Logging into the configuration page

Clicking on the `Configure` section of the title bar, or any link on the homepage that would take you to the configuration section, will bring you to a gateway log-in page.

Gateway access is controlled by a user source, in the same way that projects and the designer are protected. The gateway settings dictate which roles are allowed to have access. It is important that the gateway be kept secure, therefore you should quickly change the default authentication settings.

Default Login

When the system is first installed, the gateway can be access with the following credentials:

```
Username: admin
Password: password
```

As mentioned above, it is strongly suggested that you quickly change these default settings to something more secure. See the Managing Users section for more information.

4.3 Basics

4.3.1 Basic Gateway Settings

The basic gateway settings are found under `Configuration > Gateway Settings`. They define high-level settings that apply to the entire gateway.

System Name
A unique name for this Ignition installation. It is used to distinguish between this server and others on the network when working with multiple Ignition installations.

System user source
The user source used to secure access to the Gateway, as well as to the Designer.

Gateway Config Roles

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A comma-separated list of roles, one of which will be required in order to log into the Gateway's configuration section. These roles roles should be defined in the System user source.

Status Page Roles
Required roles to access the Gateway's status section. Leave blank to remove security restrictions for this section.

Home Page Roles
Required roles to access the Gateway's home section. Leave blank to remove security restrictions for this section. Note that this is only used to limit access to the homepage itself, each project will have its own user source for limiting access to the runtimes.

Designer Roles
The roles that will be granted access for logging into the Designer.

Use SSL
Forces the clients to use SSL encrypted communication when talking to the gateway. It is recommended that you purchase and install a genuine SSL certificate if you use this option. See the guide in the Deployment section of this manual.

Persist Alarms
Whether or not alarm properties such as acknowledgment should be persisted across Gateway restarts.

Update Notifications
When enabled a notification bar will be displayed at the top of the configuration page when a new version of Ignition is available for download. This only works if your server is connected to the internet.

Launch Link Script Policy
Controls how the HTML that launches Clients and Designer functions. If set to `JavaScript`, the links will use javascript to attempt to launch directly using the Java browser plugin. If set to `Direct`, the links will be direct links to the `*.jnlp` files that launch the Client or Designer.

Allowed JREs
Which versions of the Java Runtime Environment will be allowed to web-launch clients and designers.

Designer Memory
The maximum memory that the designer may use.

Disable Direct3D / Disable DirectDraw
These advanced properties affect launched Clients and Designers on Windows OS only. These flags control whether or not the Java Swing windowing subsystem may use Direct3D and/or DirectDraw. Disabling these features may incur a performance penalty, but might be required for some video cards that have faulty DirectX drivers.

Scheduled Backups
These 4 properties (enable, backup folder, backup times, and retention count) control the Gateway's scheduled backup system. This system is capable of automatically making a Gateway backup and storing it to a folder path, which may be a network path. When you enable this system, you must specify a destination folder. This may be a local folder, for example `"C:\backups"` or `"/var/backups"` or a network path such as `"\\fileserver\backups"`.

The scheduled backup system works on a schedule that is specified using UNIX crontab syntax. This is a standard format for specifying a basic schedule. The format consists of five space-separated fields, one for minute, hour, day-of-month, month, and day-of-week. The special character * means "all". Slashes can be used to indicate that values should be stepped, for example, */5 in the minutes

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field means "every 5 minutes", or 0:00, 0;05, 0:10, etc. Some examples:

`5 * * * *`	Once an hour, on the :05 minute. 0:05, 1:05, 2:05, etc.
`*/15 * * * *`	Every 15 minutes, on the quarter-hour. 0:15, 0:30, 0:45; 1:00, 1:15, etc.
`30 5 * * Mon`	Every Monday at 5:30am
`* 6-14 * * *`	Every minute, but only between 6am and 2pm
*/5 8-17 * * 1-5	Every 5 minutes between 8am and 5pm but only during the week (1-5). 0=Sunday, 1=Monday, etc.
0 1 5 * *	Once a month, on the 5th day at 1am

If something is wrong with the scheduled backup system it will store error messages to the Gateway logs.

4.3.2 Gateway Homepage Customization

It is possible to modify the options available on the gateway homepage from the Homepage Config section, a tab under `Configuration > Gateway Settings`.

This section allows you to specify which panels are shown, whether they are initially expanded or collapsed, and the order in which they appear.

4.3.3 Setting the Port

By default, the Ignition server runs on port `8088`. There are a variety of reasons why it might be necessary to change this, such as the port already being used by another application, or the desire to run on a more "user-friendly" port, such as 80.

The port can only be set through the Gateway Control Utility. It cannot be changed from the gateway configuration portal.

If the port is already in use, the Ignition gateway will not be allowed to start. In this case, the Gateway Control Utility may be used from the server machine to select a different port for the server.

4.3.4 Resetting the trial period

When unlicensed, the Ignition gateway will run for two hours at a time. After the trial period has expired, all unlicensed modules will be stopped.

You can reset the trial period by logging into the gateway configuration section and selecting "Reset" from the trial banner. It is possible to restart the trial period any number of times. Depending on the module, additional action may need to be taken. For example, the Vision Clients require the user to log out and back in in order to continue the trial.

4.3.5 Activation

4.3.5.1 Online Activation

All activation activity is performed in the gateway configuration portal under `System > Licensing`. The general topic of activation is described in the introduction under Licensing, Activation, and Trial Mode.

If you have been issued a CD Key and wish to activate online:
1. Click on the "Purchase or activate..." link on the licensing page.
2. Click on "Activate"

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3. Enter your CD Key
4. The request will be processed over the internet. If a connection is not available, you will be redirected to a page that allows you to perform an offline activation.

4.3.5.2 Offline Activation

Offline activation is used to activate servers when an internet connection isn't available. The process consists of generating a secure file, transferring it to Inductive Automation, and receiving back a corresponding license file.

To activate off-line, follow the same steps as outlined in the Online Activation section. After entering your CD Key, you will be presented with a screen where you can download your activation request file.

Methods of Transferring the Activation Request

The activation request file may be used on the Inductive Automation website to generate an activation file instantly. Additionally, you may email it to support@inductiveautomation.com. It will be processed and returned within 1 business day.

Installing the License File

Once a license file has been generated from an activation request, it can be loaded by returning to the Licensing section of the gateway configuration portal.

4.3.5.3 Unactivation

Only one Ignition gateway instance is allowed to be activated at a given time, for a given CD Key. If you would like to activate Ignition on a different server, you must first *unactivate* the previous server.

To unactivate, go to `System > Licensing`. On that page you will see the currently installed license, with the option to "unactivate" at the bottom of the display. Clicking this link and following the instructions will initiate the unactivation procedure.

Unactivation is virtually the exact opposite of Activation. In the process, an "unactivation request" will be generated. The software will be unactivated immediately, but a new activation will not be available until the unactivation request is received by Inductive Automation. There are both online and offline options for transferring the request, as with activation.

4.3.5.4 Updating the License

If you wish to modify your license in order to add or remove modules, or change the level of a particular license, you will need to contact Inductive Automation. The modules will be adjusted for the CD Key, and you will then be able to re-activate the system using the same key. If your Ignition Gateway is connected to the internet you can merely click the "Update License" link that is found on the licensing page of the configuration section. For systems that do not have an internet connection you will have to go through the offline unactivation process followed by the offline activation process. Once your new license file is installed, the Ignition server will be updated with the desired module licenses.

4.3.6 Gateway Console

The Gateway Console provides a wealth of information about the running state of the gateway. It is located under `System > Console`, in the gateway configuration portal. Most of the features in this section are for advanced troubleshooting, and are not often consulted in normal operation. Of all of the

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tabs in this section, the Log Viewer is the most useful for system administrators.

Log Viewer

The log viewer shows the most recent output of gateway "loggers"- units in the gateway application that output information.

Levels

The Levels tab shows all of the registered system loggers, and the level of detail that they should record.

Threads

This section shows the current state of all system threads.

Memory

Provides a breakdown of how memory is being used by Ignition.

Execution

Show a list of all registered "executors"- tasks that perform repeat operations.

Advanced

This section is the entry point to the Raw Settings Viewer. The Raw Settings Viewer allows advanced users to make queries against the internal database for advanced troubleshooting purposes. There is potential to really do some damage to the Ignition installation if one isn't careful. Use extreme caution when working directly with the internal database.

4.4 Projects

4.4.1 What is a Project?

An Ignition *project* is a unit of configuration that consists of:
- Windows
- Transaction Groups
- General Settings
- Security Settings

Each runtime client or designer can operate on one project at a time. If a project contains viewable elements (windows, reports) a launch link for it will appear on the gateway homepage. Otherwise, the project will run in the gateway and will not have a client runtime.

There is no limit to the number of projects that can be created on a gateway.

What is *not* part of the project?

SQLTags providers, database connections, OPC server connections, OPC-UA module device configurations, alarm notification pipelines are all *not* contained in a project. These settings are shared by all projects on the system.

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4.4.2 Project Management

Project management is performed under `Configuration > Projects` in the gateway. Some project management can also be performed through the designer. See Designer Project Properties for more information.

Creating a new Project

To create a new project, click on "Create new project" from the project management page. To create a new project you'll define:

Name - A unique name for the project in the system. The name may only consist of alphanumeric characters and the '_' character. Spaces and other special characters are not supported. Note: it is not advisable to change this after it's been created, instead, change the *Title* if you want to change how the project appears later.
Description - Purely for informational purposes for the user.
Title - How the project will appear to users.
Enabled - Determines whether or not the project is enabled. A disabled project will not be available to launch from the gateway and none of the transaction groups or gateway scripts will run.

Additionally, there are a few crucial properties that dictate how the project is accessed and how elements inside of it act:

user source
The profile to use for granting access to the project. For more information, see the Security section.

Default Database
All elements of the project will use this database connection unless explicitly specified otherwise.

Default SQLTags Provider
The primary SQLTags provider for the project. Most installations will likely only have one provider, but in situations where there are more than one, this is the provider that will be used by default.

Deleting Projects

Projects can be deleted by selecting the "Delete" option to the right of the project name in the list. Be aware that this action cannot be undone, and once a project is deleted it is gone forever (unless it can be recovered from a backup or auto-backup. See the Backups section for more information).

Copying Projects

Projects can be cloned easily using the "Copy" link next to the project's entry. This is useful for creating a "snapshot" of a project before starting major changes, or for creating a starting point for a new project based on an old one.

4.4.3 Project Versioning

Each project can have two distinct versions at once: the *Staging* version and the *Published* version. By default, a new project is configured to be in *Auto* publish mode, which means that the two versions are always identical. However, if you change a project to be in *Manual* publish mode, then you can explicitly publish a project in the Designer.

Published vs Staging

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The general idea between having a published version and a staging version is to allow you to save a project, and then test out the changes before "publishing" those changes to a production environment. Under normal conditions, Vision module clients run the published version of a project. However, by launching a client in a special mode (from the Designer or from the Config section of the Gateway), you can launch a client that runs the staging version of that project. This staging client will receive updates on every save, where the production clients receive updates only on publish. This lets you test out your changes to the project in an actual client, which is more realistic than the Designer's preview mode.

Not all aspects that comprise a project use this system. It is primarily intended for systems such as the Vision module's clients. Features that run persistently on the Gateway, such as SQLTags, the SQL Bridge's Transaction Groups, and Gateway-side scripting always run the most recently saved changes (the Staging version). Since these features by definition must run in exactly one place, they cannot be effectively "tested out" by simultaneously running a staging version alongside a published version.

Project Versioning and History

Each project keeps a log of recent changes. These include both saves and publishes. Every save increments a number called the "edit count" for the project, which can be used like a serial number. The user, time, affected resources, and a commit message (see below) are logged as well.

Commit Messages

A project may be configured to prompt the user making changes to describe those changes, either on every publish event, or on every save and publish event. These messages, called *commit messages*, are used to describe the changes that have been made to the project. By inspecting the project's history and reading these commit messages, you can learn what changes have been made to the project, for what reason, and by whom.

See also:
Project General Properties

4.4.4 Importing and Exporting Projects

There are two primary ways to backup and restore projects.

System backup / restore

A project can be backed up as part of a full system backup. A system backup includes all of the projects in the system, in addition to all of the settings. Restoring a system backup will replace all current projects and settings on a gateway. See Backups for more information.

Project export / import

Projects can exported and imported individually through the project management page. Click the *download* link to retrieve the *.proj file for the project. To restore, click the *upload project* link below the project table.

Project exports only include project-specific elements, like windows and groups. They do not include gateway settings, like database connections and device configurations.

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4.5 Modules

4.5.1 Module Management

All module configuration is performed under `Configuration > Modules`. Note that this section is used solely for adding, removing, and restarting modules. Modules integrate their settings into the gateway configuration tree, and therefore do not offer settings in this section.

Installing, Upgrading and Uninstalling Modules

Modules can be installed by selecting *Install or Upgrade a Module* below the module list. To uninstall a module, click *uninstall* next to its entry in the table.

Modules are hot-swappable, so these actions can be performed while the system is running. Furthermore, the isolated nature of modules ensures that performing one of these actions will only affect that particular module, and any modules which depend on it. For example, uninstalling the SQL Bridge module will not affect any running Vision module clients.

Restarting a Module

Modules can be restarted by clicking the *restart* button next to their entries. As mentioned above, the isolated nature of modules means that the other modules will not be affected by the restart (unless they depend on that particular module).

Module Status

The installed module list also provides some basic information about the state of the module. The version, license and state are all displayed in the list. Module licensing is performed centrally in `System > Licensing`, so the values here are only for information purposes.

4.6 Databases

4.6.1 Databases Overview

Database access is at the heart of the Ignition platform, enabling you to create robust data-centric systems. Relational "SQL"-based databases are extremely common in modern companies, and offer a tremendous amount of power and flexibility in storing, calculating, and manipulating data. By connecting Ignition to one or more databases, you can leverage this power to create systems that expose data, store historical information, and more.

Uses of Databases in Ignition

The following are a few places that databases are used in Ignition. While connecting to a database is not required for basic status and control functionality, it can dramatically increase the possibilities that the system offers.

Historical Data Logging

Logging data for historical analysis, either through SQLTags Historian or with the SQL Bridge module, requires a database connection. Databases are great at handling historical data, and by using a standard relational database your data is stored in an open format that can be used in many ways.

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Reports, Graphs and Charts
The Vision module makes it easy to present data stored in databases in a variety of ways. You can quickly create charts that show performance over time, locate anomalies, detect trends, and more. Furthermore, it's important to remember that it is possible to pull data from any database that Ignition is connected to, even if the data wasn't placed there by Ignition. This means you can tie in data from other sources or areas of your company, such as pulling in inventory and staff information, as well.

Storing Alarm Logs
Store alarm information historically and examine it later for patterns or trouble spots.

Database-driven SQLTags
It is possible to use a SQL database as your SQLTags repository. Any other Ignition system with access to the database will be able to share and contribute tags, allowing you to create highly integrated distributed systems. For example, multiple plant sites could use SQLTags to report current status over a secure network connection to a central corporate headquarters.

Getting Started with Databases

The first step in using a database with Ignition is to identify or setup a database server. Many companies already have database servers maintained by their IT departments. If you do not, or wish to set up your own database server for Ignition, the Supported Databases section offers some advice on choosing a database vendor.

Once you've identified a server, all you need to do is create a connection to that server to get up and running.

4.6.2 Supported Databases

Ignition has been tested with the following databases, and can connect to them directly after installation. It is possible to connect to other databases by installing additional JDBC drivers (the Java database connection specification), which are often provided by database vendors.

Full support

Database	Version
MySQL	5.0+ for full support. Ignition will connect to 4.x, but many features such as SQLTags have not been tested.
Microsoft SQL Server	2005, 2008, full and express editions. Ignition will connect to 2000, but has not been fully tested.
Oracle	10g, 11g, full and express.
PostgreSQL	8.0+

Limited support

Database	Version
Microsoft Access	Access support is very limited, and should only be used to integrate existing data into the project, not for storing new data.
Other JDBC drivers	Due to variances in databases, some features may not work fully through other non-tested JDBC drivers. However, it is usually possible to get full functionality though the careful use of the *database translator* feature.

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Choosing a database

If you are new to working with SQL databases and are trying to choose a vendor, there are several factors to weigh:

Existing company usage - Many companies already use SQL databases for other purposes, and thus most IT departments already have a defined standard. Going along with your company's existing standard is usually recommended, as there will already be staff available who are knowledgeable about the system. Furthermore, you may be able to tie into your company's existing database system instead of maintaining your own.

Price and Features - The fully supported databases above vary dramatically in price. Some systems can cost thousands of dollars, but may have a free "express" edition that will work perfectly well for your requirements. Others offer advanced features such as redundancy, which are either not offered or difficult to configure in the other systems. It is therefore important to clearly define the features and capabilities that you need.

Most common among Inductive Automation users - choosing a database that is commonly used by Inductive Automation users means that you are more likely to find examples and help in the forum, among other benefits. The supported database list above is sorted according to our current user install base.

4.6.3 Database Connections

4.6.3.1 Creating and Editing Connections

Database connections are managed in the gateway under `Databases > Connections`. To create a new connection, click the *Create new Database Connection* link below the connection table.

Select a driver

Select the appropriate database driver for the server that you'll be connecting to. If a suitable driver isn't present in the list, you may need to install a new JDBC driver.

Configure Connection

After selecting the driver, you'll configure the settings for the connection. Some settings, such as the *Connect URL* may be specific to the driver that you're using.

Connection Settings

Connect URL	A string that instructs the driver how to connect to the database. This string will include the server address, and may include the port, instance name, database name, etc. The format and parameters will depend on the driver being used.
Username	The username to use when connecting. Some databases support other authentication methods, such as Windows authentication, in which case this field would not be used.
Password	The password to use for the given username.
Extra Connection Properties	Depending on which database you are connecting to there will be different default values placed in this box. MS SQL Server requires you to place your database name here, but for other databases you can usually leave this at its default values. Each database has its own set of available extra connection properties so you must refer to your DB documentation to determine what is valid here.
Enabled	Allow you to enable or disable a database connection.
Failover Datasource	The connection to use when this connection is not available.
Failover Mode	How to handle failover and recovery. See below for more information on failover.
Slow Query Log Threshold	Queries that take longer than this amount of time, in milliseconds, will be logged making it easier to find queries that are not performing well.

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Advanced Settings

There are a variety of advanced settings that should not need to be changed under normal circumstances. Their descriptions are shown on the settings page.

Database Connection Failover

Database connections support "failover", by which objects that use that connection will use a different connection if it is unavailable. The *failover datasource* determines which connection will be used, and the *failover mode* determines when, if ever, the connection will switch back to the primary connection. *Standard* mode dictates that the secondary connection will be used only until the primary connection is available again. *Sticky*, instead, will continue to use the secondary connection until that connection fails, or until the system is restarted.

4.6.3.2 Monitoring Connection Status

Database state can be monitored from the Status section of the gateway, under `Status > Database Connections`.

The status panels show the current state and a fault message, if applicable, or throughput statistics if the connection is active. When a connection is not available, it will be re-tested every 10 seconds, and the status will be updated.

4.6.3.3 Connecting to Microsoft SQL Server

Microsoft SQL Server is a popular robust relational database produced by Microsoft. Ignition can connect to Microsoft SQL Server, however many users find difficulty in getting all of the settings and parameters correct. There are several different ways you can connect to Microsoft SQL Server (all using TCP/IP communication):

Specifying a Port using Windows Authentication
Specifying an Instance Name using Windows Authentication
Specifying a Port using SQL Authentication
Specifying an Instance Name using SQL Authentication

The most common method, the one out of the box, is to connect using an Instance Name and Windows Authentication.

SQL Server Instances

Microsoft SQL Server supports multiple instances of the database running concurrently on the same computer. Each instance has its own name and set of system and user databases that are not shared between instances. Applications, such as Ignition, can connect to each instance on a computer in much the same way they connect to databases running on different computers. Each instance gets assigned a dynamic TCP/IP port on startup that it will listen on for any incoming requests. Since the port is dynamic and the application will not know what the new port is, it must connect using the instance name.

If the communication is over TCP/IP and the application knows the instance name, how will the application find which port to communicate over?

The answer is the Microsoft SQL Server Browser Service. The Microsoft SQL Server Browser program runs as a Windows service and listens for all incoming requests for resources and provides information,

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such as the TCP/IP port, about each instance installed on the computer. Microsoft SQL Server Browser also contributes to the following actions:

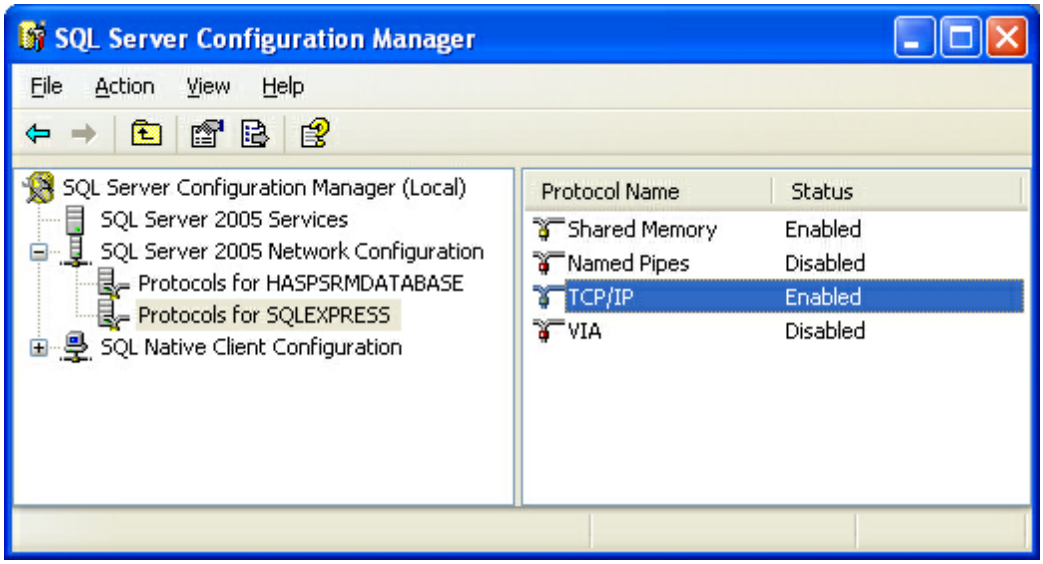
Browsing a list of available servers
Connecting to the correct server instance

If the Microsoft SQL Server Browser service is not running, you are still able to connect to SQL Server if you provide the correct port number. For instance, you can connect to the default instance of SQL Server with TCP/IP if it is running on port 1433.

Check 1: Make Sure the Database has TCP/IP Enabled

Ignition connects using TCP/IP, so the first step is to make sure your database has TCP/IP enabled. To check:

1. Open up the SQL Server Configuration Manager from Start > All Programs > Microsoft SQL Server Version # > Configuration Tools > SQL Server Configuration Manager.
2. Once it is open, you will see all of the instances setup on that machine by expanding "SQL Server Version # Network Configuration".
3. Find the database (or instance) you plan on using and click on it.
4. To the right you will see all of the protocols the database supports. One of the protocols is TCP/IP. Make sure the status next to TCP/IP is set to Enabled. If not, double click on "TCP/IP" and choose Yes from the drop-down next to Enabled and press OK.



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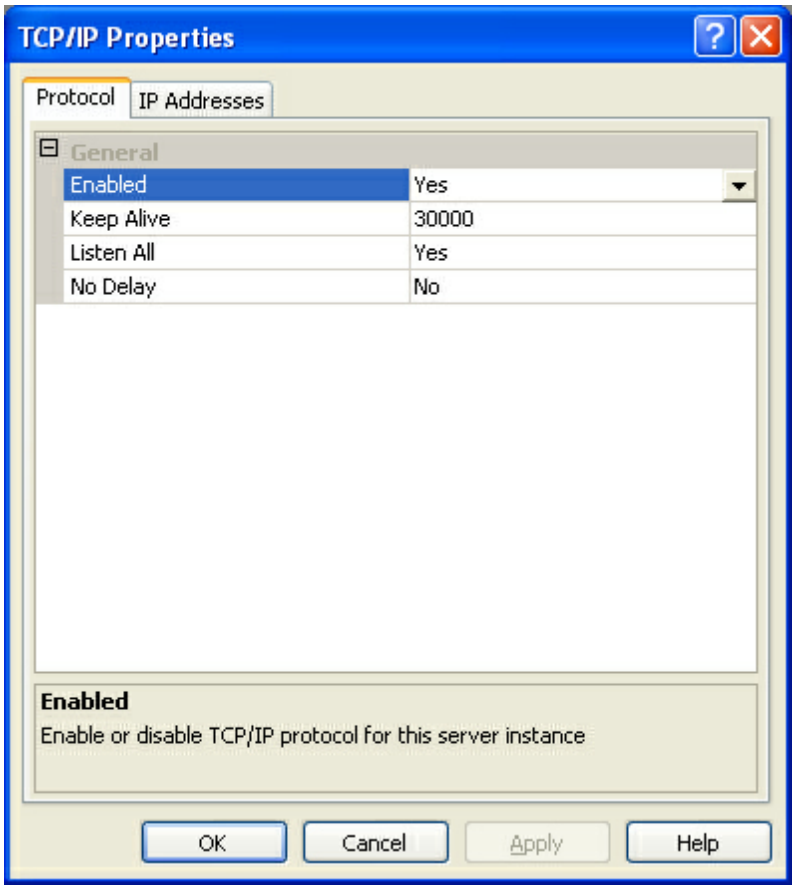

Check 2: Make Sure Microsoft SQL Server Browser is Running

If you ARE connecting to your database using a NAMED INSTANCE you must make sure that the Microsoft SQL Server Browser is running. As mentioned earlier, the Microsoft SQL Server Browser translates the instance name to a TCP/IP port in order for your application (Ignition) to connect to it. To check:

1. Open up the SQL Server Configuration Manager from Start > All Programs > Microsoft SQL Server Version # > Configuration Tools > SQL Server Configuration Manager.
2. Once it is open, select the "SQL Server Version # Services" section.
3. To the right you will see all of the services installed. One of the services is the "SQL Server Browser". Make sure this service is in fact running. If the service is not running, right click and select Start.

   Note: The service could be disabled so you may have to double click on it to enable the service before starting it up.

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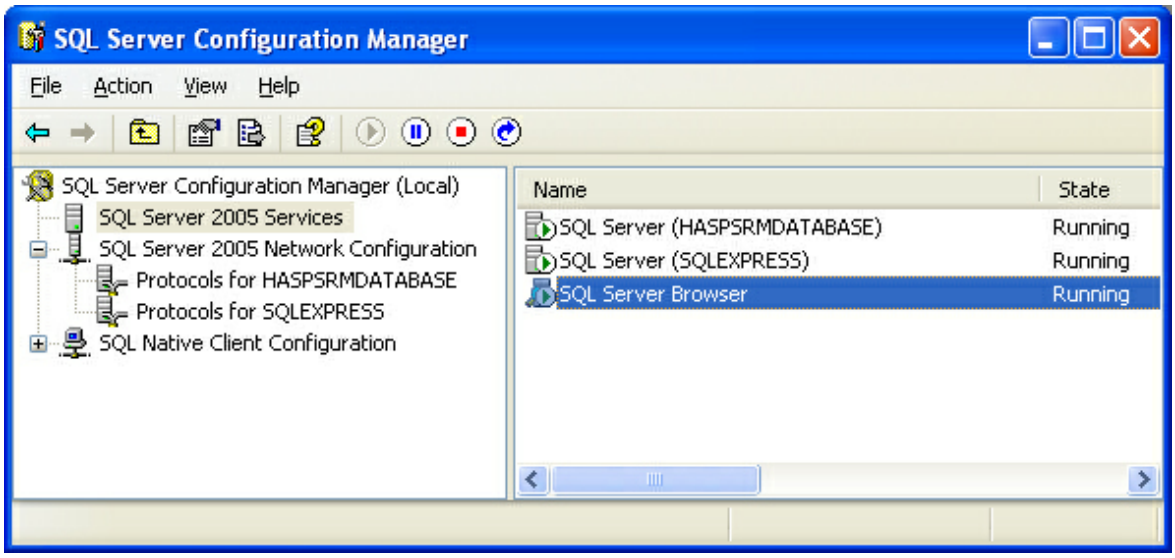

Scenario 1: Connecting Using Instance Name and SQL Authentication

Since we are using SQL authentication, Microsoft SQL Server must allow this type of authentication. By default, Microsoft SQL Server only allows Windows authentication since it is more secure. To enable:

1. Open the SQL Server Management Studio from Start > All Programs > Microsoft SQL Server Version # > SQL Server Management Studio.
2. Once open and connected to your database, right click on the top level database in the Object Explorer and select Properties.
3. Select Security on the left hand side.
4. Verify that "SQL Server and Windows Authentication" mode is selected. If not, select it and press OK.
5. You will have to restart the "SQL Server Windows" service for this setting to take effect. Open the "SQL Server Configuration Manager" (from previous steps) and restart the "SQL Server (Instance Name)" item from the "SQL Server Services" section.

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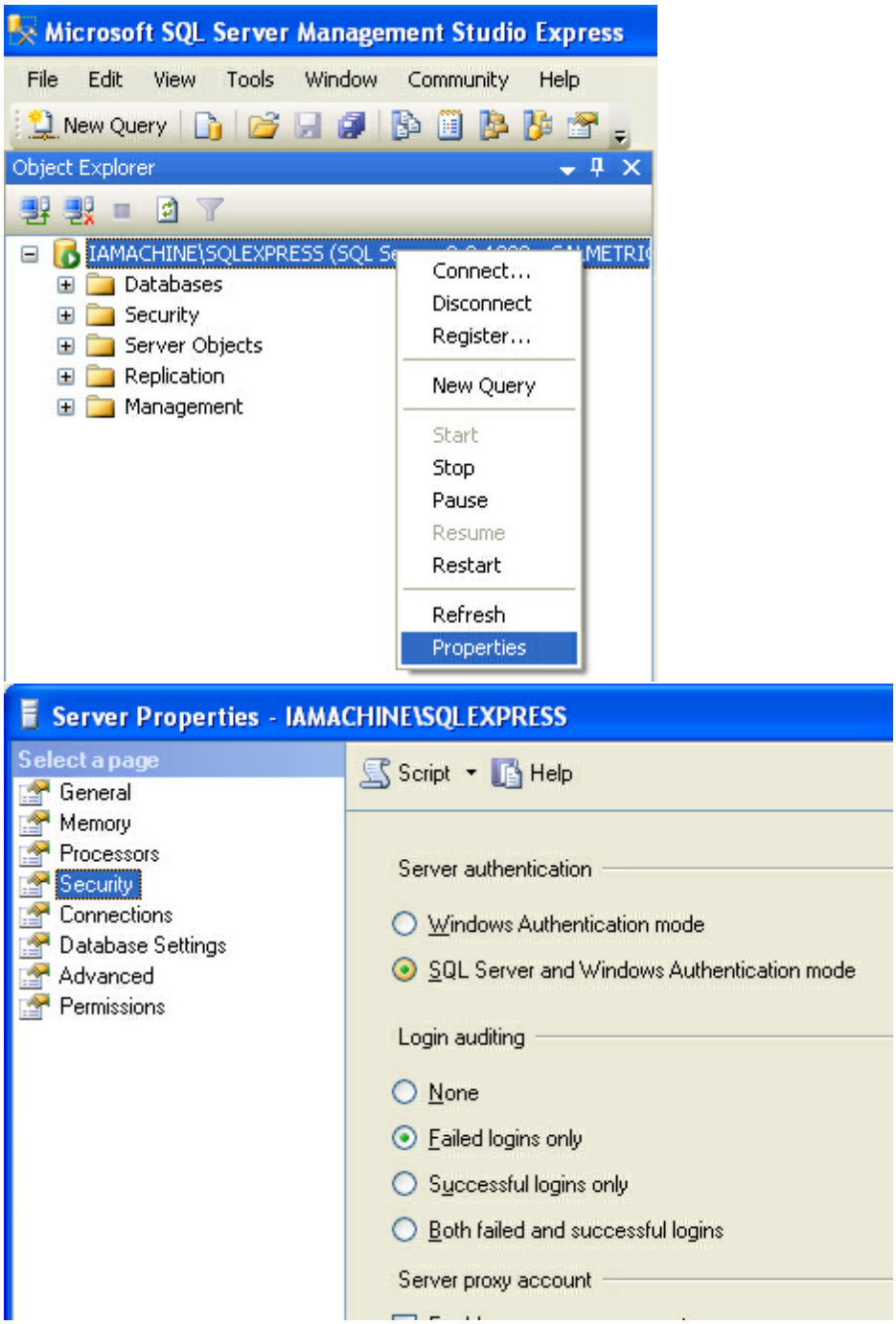

Now that Microsoft SQL Server accepts SQL authentication we can move to configuring Ignition. Follow these steps:

1. Open and login into the Ignition Gateway configuration page from your web-browser. *(http://hostname:8088/main/web/config)*
2. Select Databases > Connections from the menu.

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3. Click "Create new Database Connection"
4. Select the "Microsoft SQL Server JDBC Driver" and press next.
5. Give the connection a name like "SQL Server SQL Auth"
6. Set the "Connect URL" to:

   ```
   jdbc:sqlserver://Hostname\InstanceName
   ```

   Replace the "Hostname" with your databases IP address or hostname and replace the "InstanceName" with your databases instance name. Here are a couple of examples:

   ```
   jdbc:sqlserver://localhost\SQLEXPRESS
   jdbc:sqlserver://10.10.1.5\MSSQLSERVER
   ```

7. Set the username and password to a valid SQL authentication user. For example, "sa" is an administrator account you can use. To add your own user account open the "SQL Server Management Studio", expand the Security > Logins folder. There you can see all of the current logins. Right click on the Logins folder and click "New Login...". Choose the SQL Server authentication mode and type in a username and password. Note: You will also have to add permissions to your database by mapping "db_datareader" and "db_datawriter" to the new user in the "User Mapping" section.
8. Lastly, set the "Extra Connection Properties" to your database. For example:

   ```
   databaseName=test
   Replace "test" with your database name.
   ```

9. Press "Create New Database Connection" and the status should be Valid after a couple of seconds.

If the connection is "Faulted" click on the "Database Connection Status" link to find out why. Typically the username/password is incorrect or the user doesn't have the right permissions.

Scenario 2: Connecting Using Instance Name and Windows Authentication

In Windows authentication mode, the username and password used to connect comes from the Ignition Windows Service logon. By default, the Ignition Windows Service is set to local system account which usually doesn't have privileges to connect. To connect using Windows authentication:

1. First we have to download the necessary microsoft .dll files. We have made these available to here:

   http://files.inductiveautomation.com/sqlserver_winauth_dlls/auth.zip
2. Extract the files to your desktop. Locate the sqljdbc_auth.dll from the correct architecture folder (x86 for 32-bit and x64 for 64-bit)
3. Copy the *sqljdbc_auth.dll* file to the following location:

   ```
   C:\Program Files\Inductive Automation\Ignition\lib\
   ```

4. Now let's setup Ignition to logon using the right Windows account. Open the "Services Control

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Panel" from Start > Control Panel > Administrative Tools > Services.

5. Right click on the "Ignition" service and choose "Properties".
6. Select the "Log On" tab.
7. Choose "This Account" and enter in your Windows username and password. Press OK to save.
8. Restart the Ignition service by either clicking the restart button in the toolbar or stopping and starting from the right click menu.

Now we can move to configuring the database connection in Ignition. Follow these steps:

1. Open and login into the Ignition Gateway configuration page from your web-browser. *(http://hostname:8088/main/web/config)*
2. Select Databases > Connections from the menu.
3. Click "Create new Database Connection"
4. Select the "Microsoft SQL Server JDBC Driver" and press next.
5. Give the connection a name like "SQL Server Windows Auth"
6. Set the "Connect URL" to:

   ```
   jdbc:sqlserver://Hostname\InstanceName
   ```

   Replace the "Hostname" with your databases IP address or hostname and replace the "InstanceName" with your databases instance name. Here are a couple of examples:

   ```
   jdbc:sqlserver://localhost\SQLEXPRESS
   jdbc:sqlserver://10.10.1.5\MSSQLSERVER
   ```

7. Leave the username and password blank.
8. Lastly, set the "Extra Connection Properties" to your database and set it to use "Integrated Security". For example:

   ```
   databaseName=test; integratedSecurity=true;
   ```

   Replace "test" with your database name.
9. Press "Create New Database Connection" and the status should be Valid after a couple of seconds.

Again, if the connection is "Faulted" click on the "Database Connection Status" link to find out why.

Scenario 3: Connecting Using Port and SQL Authentication

Connecting using a port and SQL authentication is just like scenario 1 above except we specify a port instead of the instance name. Set the "Connect URL" in step 6 to:

```
jdbc:sqlserver://Hostname:Port
```

Replace the "Hostname" with your databases IP address or hostname and replace the "Port" with your databases TCP/IP port. Here are a couple of examples:

```
jdbc:sqlserver://localhost:1433
```

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```
jdbc:sqlserver://10.10.1.5:1433
```

Scenario 4: Connecting Using Port and Windows Authentication

Connecting using a port and Windows authentication is just like scenario 2 above except we specify a port instead of the instance name. Set the "Connect URL" in step 6 to:

```
jdbc:sqlserver://Hostname:Port
```

Replace the "Hostname" with your databases IP address or hostname and replace the "Port" with your databases TCP/IP port. Here are a couple of examples:

```
jdbc:sqlserver://localhost:1433
jdbc:sqlserver://10.10.1.5:1433
```

Common Problems

TCP/IP Communication Not Enabled
SQL Server requires that you explicitly turn on TCP connectivity. To do this, use the *SQL Server Configuration Manager*, located in the Start menu under "Microsoft SQL Server>Configuration Tools". Under "SQL Server Network Configuration", select your instance, and then enable TCP/IP in the panel to the right. You will need to restart the server for the change to take affect.

Window Firewall
When connecting remotely, make sure that Windows Firewall is disabled, or set up to allow the necessary ports. Normally ports **1434** and **1433** must be open for TCP traffic, but other ports may be required based on configuration.

SQL Server Browser Process Not Running
To connect to a named instance, the "SQL Server Browser" service must be running. It is occasionally disabled by default, so you should verify that the service is not only running, but set to start automatically on bootup. The service can be found in the Windows Service Manager (Control Panel>Administrative Tools>Services).

Mixed Mode Authentication Not Enabled
Unless selected during setup, "mixed mode" or "SQL authentication" is not enabled by default. This mode of authentication is the "username/password" scheme that most users are used to. When not enabled, SQL Server only allows connections using Windows Authentication. Due to the ease of using SQL Authentication over Windows Authentication, we recommend enabling this option and defining a user account for Ignition.

To enable this, open the SQL Server Management Studio and connect to the server. Right click on the instance and select "Properties". Under "Security", select "SQL Sever and Windows Authentication mode".

4.6.3.4 Connecting to MySQL

Selecting the driver

After creating a new connection from the `Databases>Connections` section of the gateway, select **MySQL ConnectorJ**.

Connect URL

MySQL uses the following URL format:

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```
jdbc:mysql://hostaddress:3306/database
```

The *hostaddress* will be the address of the machine with MySQL installed, for example: *localhost, 192.168.1.1, db-server,* etc.
The *database* parameter will dictate which *database schema* the connection will target. It's important to understand that a MySQL server can host many *database files*. The connection will target one database.

Extra Connection Parameters

By default, there is one extra connection parameter defined, `zeroDateTimeBehavior`. It is usually not necessary to add more parameters.

4.6.4 Database Drivers

4.6.4.1 What is JDBC?

JDBC stands for the Java DataBase Connectivity API. It is a standardized way for Java-based applications to interact with a wide range of databases and data sources. A *JDBC Driver* enables Ignition to connect to, and use data from, a particular database system.

JDBC in Ignition

Ignition, being a Java based application, leverages JDBC in order to connect to a variety of data sources. This enables Ignition to offer a standardized set of functionality on a wide range of different systems and databases. This includes databases such as MySQL, Microsoft SQL Server, and Oracle, but additionally other lesser-known systems as well, provided the manufacturer offers a JDBC driver for the system.

JDBC vs. ODBC

JDBC differs from ODBC (Microsoft's OpenDataBase Connectivity standard) primarily in the fact that JDBC is written in Java, and thus can be used without modification in cross-platform environments. Additionally, whereas ODBC is a complex standard that is becoming technically out-dated, JDBC is a modern, clean specification for cross-vendor database access.

4.6.4.2 Can I connect using ODBC?

While it is indeed possible to connect to an ODBC data source through the use of the JDBC-ODBC bridge, this is generally not advised. The bridge is designed to offer a minimal amount of functionality, and is considered a "transitional solution", meaning that it should only be used when JDBC is not available. In other words, if a JDBC option is available, ODBC should **not** be used.

Since most commercial databases offer JDBC drivers, transition is usually as simple as recreating your connections inside of Ignition. The lack of a JDBC connection inside of Ignition does not necessarily indicate that JDBC isn't available for your particular database. Licensing restrictions sometime prevent the inclusion of drivers with 3rd party software. Therefore, before using ODBC, due diligence should be taken to verify that no JDBC solution is available.

4.6.4.3 Adding a JDBC driver

To add a new JDBC driver to Ignition, click the *Create new JDBC Driver* link from `Databases > Drivers` page. In order to install a new driver, you'll need the Java JAR file that contains it and any

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other required JARs, as well as the full name of the driver class. This name is provided in the manufacturer's documentation.

Main Properties

Classname	The full name of the JDBC driver. Should be provided in the manufacturer's documentation.
JAR files	The core JAR file containing the driver, as well as any others required by it.

Driver Defaults and Instructions

These properties will be used as defaults when creating new connections against this driver.

Driver Type	The brand of database. This is used for optimizations in the gateway, if in doubt, select GENERIC
URL Format	A template/example of the jdbc connection string to use. The driver documentation should have examples of this string.
URL Instructions	Free form instructions that will be shown to help the user create a connection.
Default Connection Properties	Any additional properties to add by default to the connection string.
Connection Property Instructions	Tips about which connection properties might be useful.
Default Validation Query	The default query that will be used to verify that the connection is available.

SQL Language Compatibility

Default Translator	The database translator that will be used by default for connections from this driver.

4.6.4.4 Database Translators

Despite the presence of a SQL standard, many database system vary in how they implement or accomplish various tasks. The JDBC driver system tries to hide these differences as much as possible, but unfortunately some differences persist.

The *database translator* system in Ignition navigates these differences as they apply to the system. It provides a way to define certain key operations that are commonly different between database vendors, such as creating auto-incrementing index columns, and the keywords used for different data types.

Translator Management

Database translators are managed in the gateway under `Databases > Drivers > Translators (tab)`. Ignition comes pre-configured with translators for the major supported databases, but it is possible to edit and remove them, as well as create new translators. It should only be necessary to create a new translator when adding a new JDBC driver for a database that does not share syntax with any of the existing translators.

Creating a New Translator

Each field of the database translator will define a pattern that will be used, with special token markers to indicate places where other values will be placed. For example, the default *Create Table* entry looks as follows:

```
CREATE TABLE {tablename} ({creationdef}{primarykeydef})
```

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In this example, *tablename*, *creationdef*, and *primarykeydef* are all tokens that will be expanded. The token *tablename* will be replaced directly with the table, but *creationdef* will be a list of columns, and *primarykeydef* will be the phrase created by the *Primary Key Syntax* entry in the translator.

Many tokens only apply to certain entries. The possible tokens are as follows:

Token	Description
tablename	The name of the table being created.
indexname	The name of the index to create, when adding a column index to the table.
primarykeydef	A clause that will define a primary key for a new table.
creationdef	The list of columns to create in the table
alterdef	A list of columns to add/remove/modify in the table
columnname	The name of a column
type	The data type of a column
limit	The value of the limit clause

Other Translator Properties

Limit Position
Defines where the limit clause should be placed. With *Back*, the limit will be placed at the end of the query. *Front* will place it directly after the "SELECT" keyword.

Column Quote Character
All columns will be created and accessed with the defined quote, which tells the database to use a specific casing, as well as avoiding collisions between the column name and database keywords.

Supports Returning Auto-Generated Keys / Fetch Key Query
Indicates whether the JDBC driver supports the return of generated keys. If the driver does not support this feature, the *Fetch Key Query* will be used to retrieve the last key.

Date Types
The keywords that will be used when creating columns of the given types.

4.7 Store and Forward

4.7.1 Store and Forward Overview

The store and forward system provides a reliable way for Ignition to store historical data to the database. Systems such as SQLTags Historian, Transaction Groups, etc. use the store and forward system in order to ensure that data reaches its destination in the database, and is stored in an efficient manner. The store and forward system can be configured in a number of ways, offering both memory buffering for performance and local disk caching for safe storage.

Primary Features and Benefits

The store and forward system offers a number of benefits over other systems that log directly to the database:

Data loss prevention - Data is only removed from the system when the write to the database has executed successfully.
Guaranteed Ordering - The store and forward system ensures that data is forwarded in the order that it arrived.
Enhanced performance - By first buffering the data in memory, the store and forward system can optimize writes, and prevent the originating systems from blocking. This means that the system is less likely to lose data samples in the event of system slow downs.

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Store and Forward Data Flow

Although the system offers settings that can affect the pipeline, by default the data flow occurs as follows:

1. Data is generated in some system
2. Data is placed in a memory buffer
3. If not removed from memory buffer in some time (the Write Time), or if a certain amount of data accumulates (Write Size), is placed in the local cache.
4. The data sink, based on a database connection, pulls data in order from the local store, and then the memory buffer, based on the "Write Time" and "Write Size" settings under "Forward Settings".
5. If the data fails to forward, either due to an error in the connection or in the data itself, it is returned to the buffer or cache.
6. If the data errors out too many times, it becomes *quarantined.*
7. Quarantined data can be managed through the gateway, and can be deleted or un-quarantined, if the error has been resolved.

Understanding the Forward Triggers

Data is forwarded from one stage to the next based on the "Write Time" and "Write Size" triggers. These settings work as an "either/or" manner, meaning that if either of them is surpassed, the data will be forwarded. One important point to note is that *the Write Size setting influences the transaction size* of similar data to be forwarded, and therefore can have a big impact on performance. As a result, the Write Time should normally be used as the controlling factor, with the Write Size set to something that will provide reasonable transactions, like 100.

4.7.2 Engine Configuration

Configuration of the store and forward engines is performed in the gateway under `Databases > Store and Forward`. Store and forward engines are directly correlated to database connections, and are automatically managed so that each connection has an engine defined.

Tip: Create multiple database connections pointing to the same database if you wish to configure multiple store and forward engines for different purposes.

Store and Forward Settings

The settings of a store and forward engine define how and when data is moved through the system. It is advisable to understand these settings and set them carefully in accordance with your goals.

Memory Buffer Settings

Memory Buffer Size

The number of records that can be stored in the memory buffer, the first stage of the store and forward chain. Other settings define when the data will move from the memory buffer forward, this setting only determines the maximum size. If the max size is reached, additional data will error out and be discarded. The memory buffer cannot quarantine data, so if there are errors and the disk cache is not enabled, the data will be lost.

If set to 0, the memory buffer will not be used.

Store Settings

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These settings apply to the local disk storage cache.

Enable Disk Cache
Turn on the hard-disk cache. Data will be stored here if it cannot be forwarded in a timely manner. The cache also stores quarantined data (data with errors).

Max Records
The maximum size of the cache. After the max is reached, data will back up into the memory buffer, and once that is full, dropped.

Write Size
The number of records that should be accumulated in the memory store before written to the cache. Writing data in blocks can increase performance, but too large of a size increases the risk of data being lost in the event of a power outage or system failure.

Write Time
The max age of records in the memory buffer before they are stored to the cache. This setting is used in combination with the write size in order to give the forwarder the opportunity to retrieve data directly from the memory store and avoid the write to disk entirely.

Forward Settings

These settings govern when data will be forwarded to the database. The data will be pulled first from the local cache, and then from the memory store. When no data is present in the cache, it is pulled directly from the memory store.

Write Size
Same as disk cache setting above.

Write Time
Same as disk cache setting above.

Schedule Pattern
If ***enable schedule*** is selected, the forward engine will only be enabled during the times specified by the pattern. The pattern can specify specific times and ranges using a simple syntax.

Schedule pattern syntax

The schedule is specified as a comma separated list of times or time ranges. You may use the following formats:

24-hour times. Ie. "8:00-15:00, 21:00-24:00", for 8am through 3pm, 9pm through midnight.

12-hour with am/pm (if not specified, "12" is considered noon): "8am-3pm, 9pm-12am"

Note: when the time period is over, any queued data will remain cached until the next execution period. That is, the forward engine does not run until all data is forwarded.

4.7.3 Store and Forward for Reliability

The store and forward system settings, while seemingly limited, offer a good deal of flexibility in tuning. Different types of situations and goals will likely require different configurations.

When the safety of the data is a concern, the goal is to get the data stored to disk as quickly as possible in order to minimize risk of loss due to a power outage or system failure. The local cache plays a crucial role in this, allowing the system to store data locally for any amount of time until the remote database can accept it. This protects against network failures and database failures, as well.

By setting the *write size* and *write time* of both the local cache and forwarder to low values, the data will

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spend less time in the memory buffer. While the memory buffer can be set to 0 in order to bypass it completely, this is not usually recommended, as the buffer is used to create a loose coupling between the history system and other parts of Ignition that report history. This disconnect improves performance and protects against temporary system slowdowns. In fact, it is recommended that for reliable logging this value be set to a high value, in order to allow the maximum possible amount of data to enter the system in the case of a storage slowdown.

Recommended Settings

These settings are merely a starting point, and should be adjusted to fit your goals.

Memory Buffer Size
1000 or higher. While the data won't reside in here for long, a high value will allow the data to enter the store and forward system, as opposed to being lost if the maximum is hit.

Disk Store - Enabled

Max Records
500,000 or higher. Like the memory store, if the maximum is reached data will be lost, so it is best to set the value high to protect against long periods of time without database connectivity.

Store Settings - Write Size
Very low, in order to get data into the cache as quickly as possible. Moving from the memory buffer to the disk store does not use transactions as much as forwarding to the database, so a low value should not impact performance too dramatically. A value of 1 is possible, though that would force all data to go to the cache before going on to the database. A value of 10 would likely be a good starting point.

Store Settings - Write Time
This should be the controlling factor in trying to get the system to forward as quickly as possible, minimizing the time that data in the memory buffer. If the write size is 1, this setting will be of little consequence, but if the value is greater than one, careful consideration should be given to this value. Ultimately, this value should only be as large as what you would be willing to lose if there were a power failure.

Forward Settings - Write Size
This value should be set to a decent size to increase transaction throughput. 100 is a good value.

Forward Settings - Write Time
This setting should be less than the Store Write Time, in order to avoid writing to the store when the target database is available.

4.7.4 Store and Forward for high-speed buffering

When configuring the store and forward system for high-speed buffering, you are expecting the case that data will come in quick bursts. By buffering the data, the system can accommodate more information than would be possible going directly against the database.

The key points in configuring a buffering system is to avoid expensive operations like storing and reading from the local cache, and to set the memory buffer large enough to accommodate the expected burst sizes.

Recommended Settings

Memory Buffer

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500 or higher. It should be high enough to accommodate several bursts of data. For example, if you expect data to be logged at 100 ms burst for 10 seconds at a time, 100 records would be the minimum value. Data will be forwarded as it comes in, according to the forward settings, but you should not rely on any particular throughput in order to avoid data loss.

Disk Store - Disabled
Depending on your requirements, the disk store should be disabled, or at least set to have high write size/count settings. Writing and reading from the cache is much slower than memory, so it is desirable to avoid it. Of course, the cache should only be disabled if it is ok to lose some data, should the database connection be down for a period of time.

Forward Settings - Write size
Should be larger than the expected burst size. Burst data will be from the same source, and therefore will benefit heavily from the optimizations in the buffer.

Forward Settings - Write Time
Should be balanced in order to give the buffer time to received multiple records that can be optimized, as describe in Write Size above. However, it should not be so long that too much data becomes scheduled to write, which could cause a system slowdown/back up.

4.7.5 Engine Status Monitoring

The store and forward engines can be monitored under the Status section of the gateway, under the `Store & Forward` menu. Each store and forward engine will be listed, each displaying the current throughput and capacity of its memory buffer and local cache.

Statistics

Availability
Shows the status of the engine, each store, and the database.

Pending
The number of records waiting to be forwarded in that section.

Quarantined
The number of quarantined records for the cache.

Store and Forward Statistics
Shows the throughput, number of transactions, and duration statistics. It is important to remember how the data flows when interpreting the statistics. The number of rows that have gone to the database will be the number forwarded from the local cache, and then the number forwarded from the memory buffer, minus those that entered the cache from there.

4.7.6 Data Quarantining

Quarantined data is data that has errored out multiple times during attempts to forward it. It has been removed from the forward queue in order to allow other data to pass. The most common reason for data quarantining is an invalid schema in the database for the data that is being stored.

Quarantined data will be held indefinitely until it is either deleted or re-inserted into the queue manually.

Quarantined data is controlled from the *Quarantine Control* tab under `Databases > Store and`

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`Forward`. The data is listed according to store and forward engine and the data format, with a description, the error that caused the quarantine, and the number of quarantined records. Next to the record, there are options to *Delete* and *Retry*.

Delete
Permanently delete the data in the selected row. All transactions of the selected type will be deleted.

Retry
Un-quarantine the data and place it back in the forward queue.

4.8 OPC

4.8.1 What is OPC?

OPC is a specification for the transport and use of industrial data. It is published and maintained by the OPC Foundation, an organization comprised of hundreds of member companies that strives to ensure interoperability on the plant floor and beyond.

History

The OPC-UA specification is the latest specification in a line spanning back to the mid '90s. The original OPC specifications used Microsoft DCOM technology to provide a uniform way for industrial applications to share data. There were several separate specifications that provided functions such as Data Access (OPC-DA), Alarms and Events (A&E), Historical data (HDA) and more.
DCOM always proved difficult to work with, and by 2004 it was clear that a more modern solution was needed. Therefore, a new specification was developed that used common networking principals instead of DCOM, was platform independent, and combined the various separate specifications into one: OPC-UA.

Clients and Servers

When discussing OPC (as the specifications are often called collectively), it is common to hear about "OPC servers" and "OPC clients". An OPC Server is a piece of software that implements the OPC interface and provides data. An OPC Client is an application which connects to an OPC Server and uses the specification to retrieve and work with data.

The Ignition platform inherently offers OPC-UA client functionality. That is, even with no modules installed, the gateway can connect to any compliant OPC-UA server and work with data. With the addition of the OPC-UA Module, Ignition becomes an OPC server as well, hosting device drivers that read and publish data.

The OPC-COM module is available to provide client access to older, DCOM based, OPC-DA servers.

Technology

The OPC-UA specification offers a wide range of flexibility in choosing technologies, from the transport mechanism, to the way data is encoded, to the encryption used to secure the data.

Ignition supports the UA/TCP transport with the UA/Binary encoding scheme for maximum performance. Additionally, Ignition supports all of the common encryption schemes.

This means that Ignition connects to OPC-UA servers (and allows connections from clients) over TCP/IP,

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using encryption, and sends data by first encoding it into an efficient format defined by the OPC-UA specification. This is in contrast to other schemes outlined in the specification, which can use web services and XML encoding, and are not as efficient.

4.8.2 OPC Connections

4.8.2.1 Connecting to OPC-UA

OPC-UA Connection

An OPC-UA Connection is used to communicate with an OPC-UA compliant server, such as the one the OPC-UA module provides. To create a new connection, go to go `OPC Connections>Servers` and click "Create new OPC Server Connection". Select "OPC-UA Connection" from the list. OPC-UA connections communicate via TCP/IP so configuration is relatively straight-forward.

Main

Name	A name used to identify this connection.
Description	Short description of this connection, i.e. "Connection to plant floor."

Connection Settings

Host	The host name or IP address of server. If the OPC-UA module is running on the same computer you are configuring this connection on then "localhost" will likely be sufficient.
Port	The port the OPC-UA server is running. The OPC-UA module defaults to running on port 4096 but can be changed on the OPC-UA module settings page.
Security Policy	A Security Policy is a set of security algorithms that will be used together during a security handshake. The OPC-UA server this connection is intended for must support the chosen security policy.
Message Security Mode	The Message Security Mode and the Security Policy specify how to secure messages sent via this connection. None - No security is applied. Sign - Messages are signed but not encrypted. Sign And Encrypt - Messages are signed and encrypted.
Enabled	A connection can be set to Enabled or Disabled. Disabled connections have their settings preserved but no actual connection is made and the server will not show up in the OPC Server Browser.

Authentication

If a username and password are specified then they will be used as a user identity token when connecting to the specified OPC-UA server.

The internal OPC-UA server provided by the OPC-UA module uses an Ignition security profile to govern who can connect to it. This can be configured in the OPC-UA module settings section.

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4.8.2.2 Connecting to OPC Classic (COM)

Important

Classic OPC is based on COM, which is a technology in Microsoft Windows. Therefore, the information in this section only applies to Ignition gateways installed on Windows. For other operating systems, OPC-UA must be used.

Introduction

The OPC-COM module provides the ability to connect to OPC servers that only communicate using the older COM based OPC-DA standard. If you have an OPC server that is not capable of accepting OPC-UA connections and you need to talk to a PLC for which Ignition has no supported driver, then you'll have to use the OPC-COM module to make your device data available in Ignition. Connections to OPC servers will be held open while the Ignition gateway is running. All subscriptions to the server will use the same connection.

This section provides a brief walk-through of how to set-up a new Local or Remote OPC-DA server connection using the COM module. Due to the complications that Windows DCOM security settings can cause, this set-up guide is followed by the Troubleshooting OPC-COM Connections section that deals with an overview of how to deal with a faulted server connection due to DCOM security settings as well as other possibilities.

Necessary Preliminary Steps - Install OPC Core Components

The OPC-COM module relies on a .dll package provided by the OPC Foundation (www.opcfoundation.org) called the OPC Core Components. You can download the OPC Core Components Redistributable from the OPC Foundation's website under the downloads section. Registration with the OPC Foundation is required before you can download the package, but the registration process is free and painless.

There are two packages to choose from, the 32-bit (x86) and the 64-bit (x64) so make sure you get the correct one for the version of Java and Ignition you are running. 64-bit Java and Ignition needs the 64-bit Core Components package and likewise 32-bit installations need the 32-bit package. It should also be noted that if you are going to be connecting to an OPC server on a remote machine then you must also install the appropriate version of the Core Components on that server as well. The version type, 64-bit or 32-bit, does not need to be the same across the two servers. Just be sure to install the version that is appropriate for the OPC Server and Windows architecture.

Once you have the correct package downloaded you can extract the contents of the .zip file and then run the installer. With the core components installed you can now proceed to setting up your OPC-DA server connection in Ignition.

Recap -

1. Register at www.opcfoundation.org
2. Download appropriate OPC Core Components Redistributable package
3. Install Core Components on Ignition server
4. (Remote) Install Core Components on remote machine running the OPC-DA server

Creating an OPC-DA Connection

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With the OPC Core Components now installed the next step is creating/configuring a new OPC-DA server connection. Follow these steps:

1. Navigate to the Ignition Gateway Configuration section (i.e. *http://localhost:8088/main/web/config)*.
2. Under OPC Connections select Servers and then select “Create new OPC Server Connection...”
3. Choose the OPC-DA COM Connection option and then select whether you want to make a local connection or if the OPC server resides on a remote machine. For the most part, setting up a local or remote connection to an OPC-DA server is the same. There are only a couple of differences for a remote connection that will be highlighted along the way.

4. **Local -** Selecting a local connection will take you to a screen that contains a list of the available and running OPC servers located on the local machine.
   Remote - For a remote connection you will first have to specify the host name or IP address of the machine the the OPC server resides on and then (as of Ignition 7.4) you will be redirected to the available servers list.
5. Select the OPC server that you wish to connect to from the list. In the case where your server is not listed then consult "OPC server is not listed..." topic of the troubleshooting section.

   Unique Remote Connection Settings:
   Remote connections have a few unique settings that you can specify. You can get to these settings by selecting the “Show advanced properties” check box. As of Ignition 7.4 these should all be set for you (except for the CLSID which should no longer be necessary but is still available for you to set if you wish).

   Remote Server
   Specifies that the server is remote and that a DCOM connection will be used
   Host Machine
   The computer name or IP address of the machine on which the remote server is running
   CLSID
   This is no longer required as of Ignition 7.4, but it is still made available for you. It can be used in place of the ProgId because the ProgId is really just used to lookup the CLSID in the registry. This id can be found in the registry of the machine hosting the server under:
   `HKEY_CLASSES_ROOT\OPCServerName\CLSID`

6. All of the settings for the server connection are rather straight forward and each property has a description of its functionality. Most of these settings should be fine when left at their default values. The only setting that could possibly give you some trouble is the ProgId. If you selected your OPC server from the list on the “Choose OPC-DA Server” page then this will be filled in for you. However, if for whatever reason your server wasn't listed and you chose the “Other Server” option then you will have to know the ProgId for your server and specify it here. The ProgId is used to look up the CLSID of the OPC Server in the Windows Registry and without this a connection cannot be made.

7. When you are finished fine tuning these settings click “Create New OPC Server Connection”. You will be redirected to the OPC Server Connections page and your new server connection should be listed. The status of your connection will read “Connected” if Ignition was able to successfully connect to the third party OPC server.

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Connection is Faulted
In the case where your connection status is reporting Faulted, the troubleshooting process begins. As previously stated, configuring the DCOM settings on your machine can be a headache. The Troubleshooting OPC-COM Connection section is an attempt to ease the process of determining why your connection is faulted and how to go about fixing the issue. If after exhausting the options presented to you there you are still having issues getting you server connection up, give our *Inductive Automation* tech support line a call and one of our representatives will be happy to assist you.

4.8.2.3 Troubleshooting OPC-COM Connections

This section is aimed at providing you with a list of common OPC-COM connection problems with their possible solutions. It would be impossible to give an exhaustive list of everything that can go wrong but this should give you a good start on the troubleshooting process. If you do not see your problem listed and your connection status is faulted, try following the steps outlined in the "Ignition Server DCOM Settings" and "OPC Server DCOM Settings" sections.

Common Problems:

OPC server is not listed in "Choose OPC-DA Server" list when first creating a connection

There are some cases in which an OPC Server that is installed will not show up in the generated list. This list is generated by the OPC Server Enumerator which is part of the OPC Core Components, so when a server you have installed on the machine does not appear in this list it is likely due to the OPC Core Components not being installed correctly.

Try reinstalling the Core Components and going through the process of creating a new server connection in Ignition again. If the server still does not appear and you have the ProgId (or the CLSID for a remote connection) for the OPC server, you can just select the "Other Server" option and then click "Next". In this situation you will have to enter the ProgId manually on the "New OPC-DA Server" page.

With all the correct information about the OPC server we can sometimes still make a valid connection to the OPC Server even when it is not detected automatically. This however is rare. Most of the time when the server is not detected, any connection attempts Ignition makes will fail.

Connection status is "Connected" but data quality is bad or the connection goes "Faulted" after trying to read tag data

Usually this occurs when the DCOM settings for the machine on which Ignition is running are not correctly configured. DCOM connections go in both directions. Ignition must be able to send requests to the OPC server and the OPC server must also be able to callback to Ignition. If the DCOM settings on the Ignition server are not configured correctly those callbacks will fail and the server connection that initially had a status of "Connected" will either fault or all the tags that you have configured will come back with bad quality.

This is a problem that can affect both local and remote server connections.

Follow the steps outlined in the "Ignition Server DCOM Settings" section to ensure that you have

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correctly configured the DCOM security settings on the Ignition server machine.

Ignition launches second instance of an already running OPC server and is unable to see any data

It is important to note that Ignition runs as a service under the Windows System account. This can cause some issues with OPC servers that are meant to run interactively, meaning they run under the user account that is currently logged on. When Ignition attempts to make a connection to the OPC server it will attempt to find an instance running under the same account and if it doesn't find one it will launch its own instance under the System account. Even if there are other instances running, Ignition will choose the one that was launched under the System account for its connection.

Many OPC servers maintain an instance running under the interactive user account that has been configured by the user and maintains all of the device connection information. When Ignition launches a new instance, this configuration information is lacking and none of the desired data can be seen or accessed. To get around this problem you must specify in the DCOM settings for the OPC server that it always identify itself with the interactive user. Essentially this will force Ignition to use the currently running instance of the OPC server.

Setting OPC server to run as Interactive User:

1. The DCOM settings are found in the Component Services manager. Right click the entry for your OPC server under the DCOM Config folder and select properties from the popup menu.
2. Select the Identity tab, select the option that reads “The interactive user” then click “OK”.
3. Close out of component services and kill any extra instances of the OPC server you see running in the Task Manager
4. Go edit and save the OPC server connection in the Ignition Gateway.

Faulted status with E_CLASSNOTREG error reported on OPC connections status page

This is almost always caused by the OPC Core Components not being installed correctly. Download and install the correct version(s) for your system(s) from the OPC Foundation (www.opcfoundation.org). Remember, if you are making a remote connection you must install these components on both the Ignition server as well as the machine on which the OPC server is running.

DCOM Settings:

Ignition Server DCOM Settings

Follow these steps to open up the DCOM security settings on the machine that is running Ignition.

1. Open up Windows Component Services, located in the Administrative Tools section of the Control panel.
2. Browse down through the Component Services tree until you see “My Computer”, right click and select “Properties”.
3. We want to focus on the COM Security tab. There are two sections, “Access Permissions and Launch” and “Activation Permissions. Each section has an “Edit Limits...” and “Edit Defaults...” button. You must add the ANONYMOUS and Everyone accounts under each of the four areas

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making sure that the “Allow” option is checked for each of the permission settings. If you skip adding both of these to either the limits or defaults areas under either of the two sections there is a good chance your connection will not be successful.

4. You can also try setting the “Default Authentication Level” to “None” and the “Default Impersonation Level” to “Identify” on the Default Properties tab. This isn't always necessary but it can sometimes help.

OPC Server DCOM Settings

Follow these steps to open up the DCOM security settings on the machine that is running the OPC server

1. Open up Windows Component Services, located in the Administrative Tools section of the Control panel.
2. Browse down through the Component Services tree until get to the DCOM Config folder. Locate the entry for your OPC server that you wish to make a connection to, right click and select properties.
3. Click the Security tab and you will see three sections, “Launch and Activation Permissions”, “Access Permissions”, and “Configuration Permissions”. There are two options to choose from for each section. If you already added the ANONYMOUS and Everyone accounts to the COM Security section from the “Ignition Server DCOM Settings” section then you can go ahead and just select the “Use Default” option for each of the three areas. The second option is to edit each of the groups that have Customize selected. You will have to add both the ANONYMOUS and Everyone accounts with all privileges.
4. Now select the Identity tab. You will notice that you can choose which account you want to run the OPC server under. Select the Interactive User option. This ensures that if Ignition launches an instance of the OPC server that it will be run under whichever user is currently logged into the system.

4.8.3 OPC Quick Client

The OPC Quick Client can be accessed from under the "OPC Connections" section of the Ignition Gateway. It allows for quick, simple testing of any devices connected to the server.

You can browse by expanding tree nodes and read/write to tags by clicking on the [r] and [w] buttons next to those tags.

Subscriptions can be made by clicking on the [s] button. Clicking on the "enable live values" link will automatically refresh subscriptions and show live value changes (if there are any).

4.8.4 Ignition OPC-UA Server

4.8.4.1 OPC-UA Server Settings

Authentication

user source — The user source that the OPC-UA module will use to authenticate incoming connections against. By default this is set to the opcua-

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	module profile. This profile is included in the default installation and has the following as its default settings: user: opcuauser password: password
Allowed Roles	Roles within the given user source that are allowed to connect to the server. Multiple roles should be separated by a comma, for example, Administrator,user,manager.
Allow Anonymous Access	If checked this will allow anonymous connections to the server.

Server

Server Port	The port the OPC-UA module runs on.
Endpoint Address	Overrides the address that will be returned in the endpoint URL during a GetEndpointsRequest from a client. This is useful if the server machine has a VPN connection or multiple adapters and is returning the wrong address.

4.8.4.2 Adding a New Device

To add a new Device go to the "Devices" section of the OPC-UA module configuration in the *Ignition* Gateway. Click "Add a Device..." and you will be taken to a page where you can select the driver to use. Choose your driver and click the "Next" button.

"General" settings common to all devices are as follows:

Device Name	The user-defined name for this Device. The name chosen will show up in OPC Item Paths and under the "Devices" folder on the OPC-UA server. The Device Name must be alphanumeric.
Browse Timeout	Amount of time (in milliseconds) before a browse operation on this device times out.
Read Timeout	Amount of time (in milliseconds) before a read operation on this device times out.
Write Timeout	Amount of time (in milliseconds) before a write operation on this device times out.
Enable Device	Only devices that are enabled will appear in the "Devices" folder of the OPC-UA server and thus have their tags available for use.

These timeout settings refer to the communication between the device driver and the OPC-UA server and usually can be left at their default values. Any device specific settings will be unique to each driver and you will see these (if there are any) listed below the "General" settings category in separate categories of their own.

4.8.4.3 Verifying Device Connectivity

Device connectivity can be verified either in the "Devices" section under the OPC-UA Server section, The Overview section of the Status page in the "Device Connections" bubble, or in the OPC-UA Server section of the Status page.

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4.8.4.4 Drivers

4.8.4.4.1 Allen Bradley Drivers

4.8.4.4.1.1 ControlLogix 5500

ControlLogix Connectivity Settings

Hostname	The Hostname value is the IP Address of the ControlLogix Ethernet module (1756-ENET) to route through to connect a ControlLogix processor. EthernetIP protocol on TCP port 44818 (0xAF12) is used to communicate to ControlLogix processors.
Communication Timeout	After sending a request to the ControlLogix processor, the Communication Timeout setting is the amount of time in mSec to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the ControlLogix processor, the Browse Cache Timeout value is the amount of time in mSec to cache the results.
Slot Number	The Slot Number value is the zero based ControlLogix chassis slot number of the ControlLogix processor to connect to.
Connection Path	The Connection Path value is used to define the route of the PLC-5 processor to connect to. Currently routing through the ControlLogix Ethernet Communication Interface Module (1756-ENET) to the ControlLogix Data Highway Plus-Remote I/O Communication Interface Module (1756-DHRIO) and on to a PLC-5 processor of the DH+ network is supported.
Concurrent Requests	The number of requests that Ignition will try to send to the device at the same time. Increasing this number can sometimes help with your request throughput, however increasing this too much can overwhelm the device and hurt your communications with the device.

More Information On Connection Path

The Connection Path format contains 4 numbers separated by commas. The first number is always 1 and tells the 1756-ENET module to route through the backplane. The second number is the slot number of the 1756-DHRIO module of the DH+ network the PLC-5 processor is connected to. The third number is the channel of the 1756-DHRIO module that the PLC-5 processor is connected to. Use 2 for channel A and 3 for channel B. The final and fourth number is the DH+ node number. This number is in octal and is the same as configured in the PLC-5 processor. See the ControlLogix Ethernet Communication interface Module User Manual for more information.

Connection Path Format: 1,<1756-DHRIO slot number>,<1756-DHRIO channel>,<DH+ node number>

The valid range for the 1756-DHRIO slot number is between 0 and 16 but depends on the chassis size.
The 1756-DHRIO channel is either 2 for channel A or 3 for channel B.
The DH+ node number range is from 00 to 77 octal.

For a more in depth explanation of connection paths please read: Allen Bradley Connection Paths Explained

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Supported ControlLogix Connection Methods

ControlLogix 5500 connected through 1756-ENET/A or 1756-ENET/B.

4.8.4.4.1.2 MicroLogix 1100/1400

MicroLogix 1100/1400 Connectivity Settings

Hostname	The Hostname value is the IP Address of the MicroLogix 1100 processor, MicroLogix 1400 processor or 1761-NET-ENI Ethernet interface. EthernetIP protocol on TCP port 44818 (0xAF12) is used to communicate to the listed devices.
Communication Timeout	After sending a request to the MicroLogix processor, the Communication Timeout setting is the amount of time in mSec to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the MicroLogix processor, the Browse Cache Timeout value is the amount of time in mSec to cache the results.

Supported MicroLogix Connection Methods

MicroLogix 1100 and 1400 direct
MicroLogix 1100 and 1400 connected through 1761-NET-ENI
MicroLogix 1100/1400 connected through Spectrum Controls WebPort 500

Note: MicroLogix 1200 and 1500 are not fully supported. Browsing is not available on these devices.

4.8.4.4.1.3 PLC-5

PLC-5 Connectivity Setting

Hostname	The Hostname value is the IP Address of the PLC-5 processor. The protocol that the PLC-5 processor supports is automatically detected. It will use either CSP protocol on port 2222 (0x8AE) or EthernetIP protocol on port 44818 (0xAF12).
Communication Timeout	After sending a request to the PLC-5 processor, the Communication Timeout setting is the amount of time in milliseconds to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the PLC-5 processor, the Browse Cache Timeout value is the amount of time in milliseconds to cache the results.
Connection Path	The Connection Path value is used to define the route of the PLC-5 processor to connect to. Currently routing through the ControlLogix Ethernet Communication Interface Module (1756-ENET) to the ControlLogix Data Highway Plus-Remote I/O Communication Interface Module (1756-DHRIO) and on to a PLC-5 processor of the DH+ network is supported.

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More Information On Connection Path

The Connection Path format contains 4 numbers separated by commas. The first number is always 1 and tells the 1756-ENET module to route through the backplane. The second number is the slot number of the 1756-DHRIO module of the DH+ network the PLC-5 processor is connected to. The third number is the channel of the 1756-DHRIO module that the PLC-5 processor is connected to. Use 2 for channel A and 3 for channel B. The final and fourth number is the DH+ node number. This number is in octal and is the same as configured in the PLC-5 processor. See the ControlLogix Ethernet Communication interface Module User Manual for more information.

Connection Path Format: 1,<1756-DHRIO slot number>,<1756-DHRIO channel>,<DH+ node number>

The valid range for the 1756-DHRIO slot number is between 0 and 16 but depends on the chassis size.
The 1756-DHRIO channel is either 2 for channel A or 3 for channel B.
The DH+ node number range is from 00 to 77 octal.

For a more in depth explanation of connection paths please read: Allen Bradley Connection Paths Explained

Supported PLC-5 Connection Methods

PLC-5 L/20E, L/40E, L/80E direct
All PLC-5 processors connected through DH+ via the 1756-DHRIO module.

4.8.4.4.1.4 SLC 505

SLC Connectivity Settings

Hostname	The Hostname value is the IP Address of the SLC processor. The protocol that the SLC processor supports is automatically detected. It will use either CSP protocol on port 2222 (0x8AE) or EthernetIP protocol on port 44818 (0xAF12).
Communication Timeout	After sending a request to the SLC processor, the Communication Timeout setting is the amount of time in milliseconds to wait for a response before treating it as a failure.
Browse Cache Timeout	When the data table layout is read from the SLC processor, the Browse Cache Timeout value is the amount of time in milliseconds to cache the results.
Connection Path	The Connection Path value is used to define the route of the SLC processor to connect to. Currently routing through the ControlLogix Ethernet Communication Interface Module (1756-ENET) to the ControlLogix Data Highway Plus-Remote I/O Communication Interface Module (1756-DHRIO) and on to a SLC processor of the DH+ network is supported.

More Information On Connection Path

The Connection Path format contains 4 numbers separated by commas. The first number is always 1 and tells the 1756-ENET module to route through the backplane. The second number is the slot number of the 1756-DHRIO module of the DH+ network the SLC processor is connected to. The third number is the channel of the 1756-DHRIO module that the SLC processor is connected to. Use 2 for channel A and 3 for channel B. The final and fourth number is the DH+ node number. This number is in octal and is the same as configured in the SLC processor. See the ControlLogix Ethernet Communication interface

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Module User Manual for more information.

Connection Path Format: 1,<1756-DHRIO slot number>,<1756-DHRIO channel>,<DH+ node number>

The valid range for the 1756-DHRIO slot number is between 0 and 16 but depends on the chassis size.
The 1756-DHRIO channel is either 2 for channel A or 3 for channel B.
The DH+ node number range is from 00 to 77 octal.

For a more in depth explanation of connection paths please read: Allen Bradley Connection Paths Explained

Supported SLC Connection Methods

SLC505 direct
SLC505, SLC504, SLC503 connected through 1761-NET-ENI
SLC504 connected through 1756-DHRIO
SLC505, SLC504, SLC503 connected through Spectrum Controls WebPort 500

4.8.4.4.1.5 Allen Bradley Connection Paths Explained

Connections to ControlLogix, CompactLogix, PLC-5, MicroLogix and SLC Allen-Bradley processors through a ControlLogix Gateway require a connection path. The connection path is unique to your setup and is dependent on what modules the connection is being routed through. With there being nearly an endless number of ways to route your connection from device to device it is impossible to give an example of every possible connection path, but in general there is a pattern to how the connection path is specified.

Follow the Path

A connection path is exactly what it sounds like. It is a path that when followed will lead a processor residing in a numbered slot of a chassis somewhere on site. You merely have to follow the path and build the connection path as you go.

The first connection point between Ignition and the device is a ControlLogix Ethernet module such as an ENET, ENBT or EN2T module. The slot number of this module doesn't matter and there is no need to specify it in the connection path. The first entry in any connection path will be a 1, which specifies moving to the back plane. You then specify the slot of the module you wish to move to, followed by the port or channel of that module that you wish to exit through. Finally you specify the address of your entry point to the next module and the process starts all over again. This process may sound complicated at first but after some practice it will get easier.

Steps

1. Move to the backplane
2. Specify the slot number of the module you are moving to
3. Specify the exit port or channel
4. Specify address of entry point (DH+ Station Number / ControlNet Address / IP Address of ethernet module)
5. Move to the backplane
6. Specify processor slot number OR the slot number of the module you wish to exit through

Connection Path Entries for Different Module Types

How you specify your exit point from a module is slightly different depending on which module type you

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are using. You can only move in two directions once you are "in" a module: out to the back plane, or out through the module port/channel. Ethernet modules have ethernet ports and an IP address; ControlNet modules have ControlNet Ports and ControlNet addresses; DHRIO modules have channels and station numbers. Below is a list of different kinds of modules and what numbers you specify in the connection path when you are exiting or entering those modules. When in a module, an entry of 1 will always take you to the backplane.

ENET, ENBT, and EN2T:
Exiting
1 = Backplane
2 = Ethernet Port
Entering
IP Address

CNB:
Exiting
1 = Backplane
2 = ControlNet Port
Entering
ControlNet Address

DHRIO
Exiting
1 = Backplane
2 = DH+ Channel A
3 = DH+ Channel B
Entering
DH+ Station Number (an octal value between 0-77)

You use these numbers to specify how to move out of the module, then you specify where you are moving to by either specifying the DH+ station number, ControlNet address, or the IP address of another ethernet module. Your connection path will always be an even number of entries due to the fact that you always move in two steps: out of a module and then in to another module. So if your connection path ends up with an odd number of entries you have missed a step somewhere and you'll have to go back and trace the path again.

Some examples have been included to help illustrate the process of tracing a connection path. The first three examples illustrate how to build your connection path when going from one ControlLogix Gateway to another. The last example shows connecting through a ControlLogix Gateway to 3 different SLC 5/04 devices via DH+.

ControlNet Example

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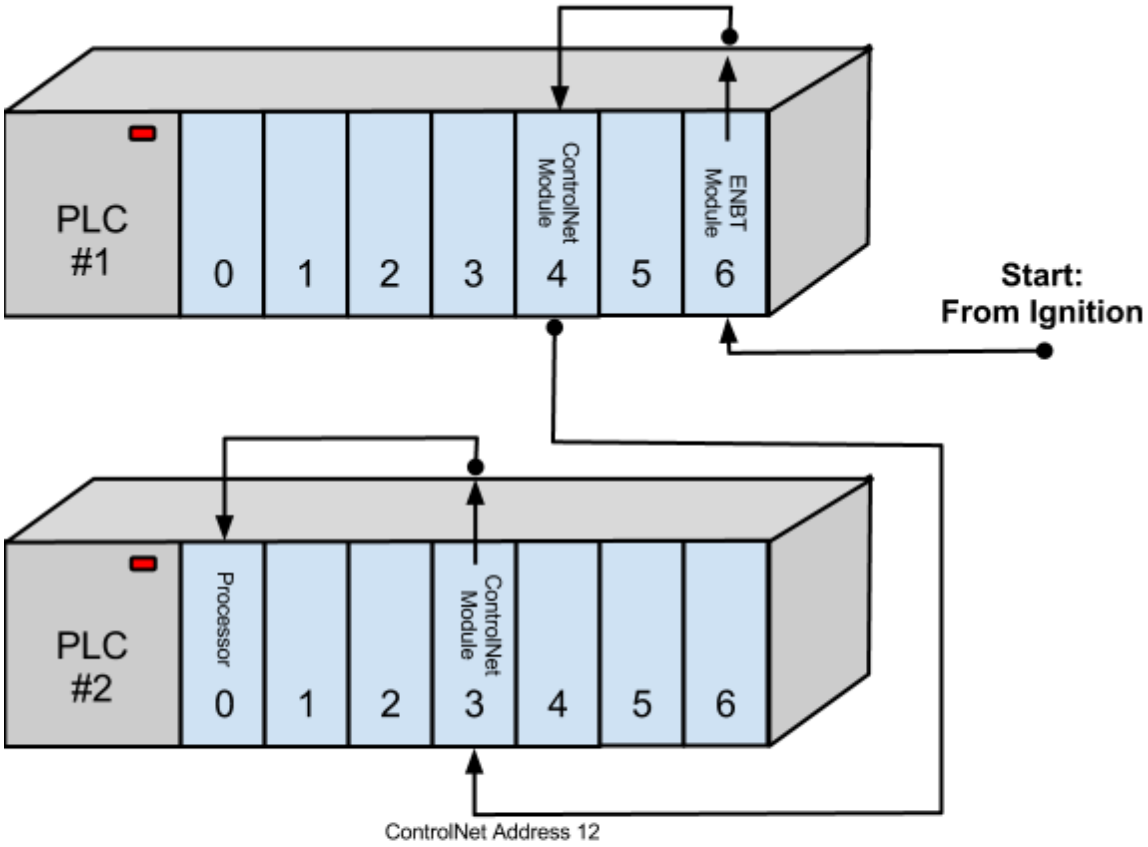

Walkthrough:
In from Ignition
Move out of ENBT to the backplane
Move to ControlNet Module in Slot 4
Move out ControlNet Port
In ControlNet Module @ ControlNet Address 12
Move out of ControlNet to the backplane
Move to the Processor in Slot 0

Connection Path: 1,4,2,12,1,0
1 = Backplane
4 = Slot 4, ControlNet Module
2 = ControlNet Port
12 = ControlNet Address
1 = Backplane
0 = Slot 0, Processor

ENBT Example

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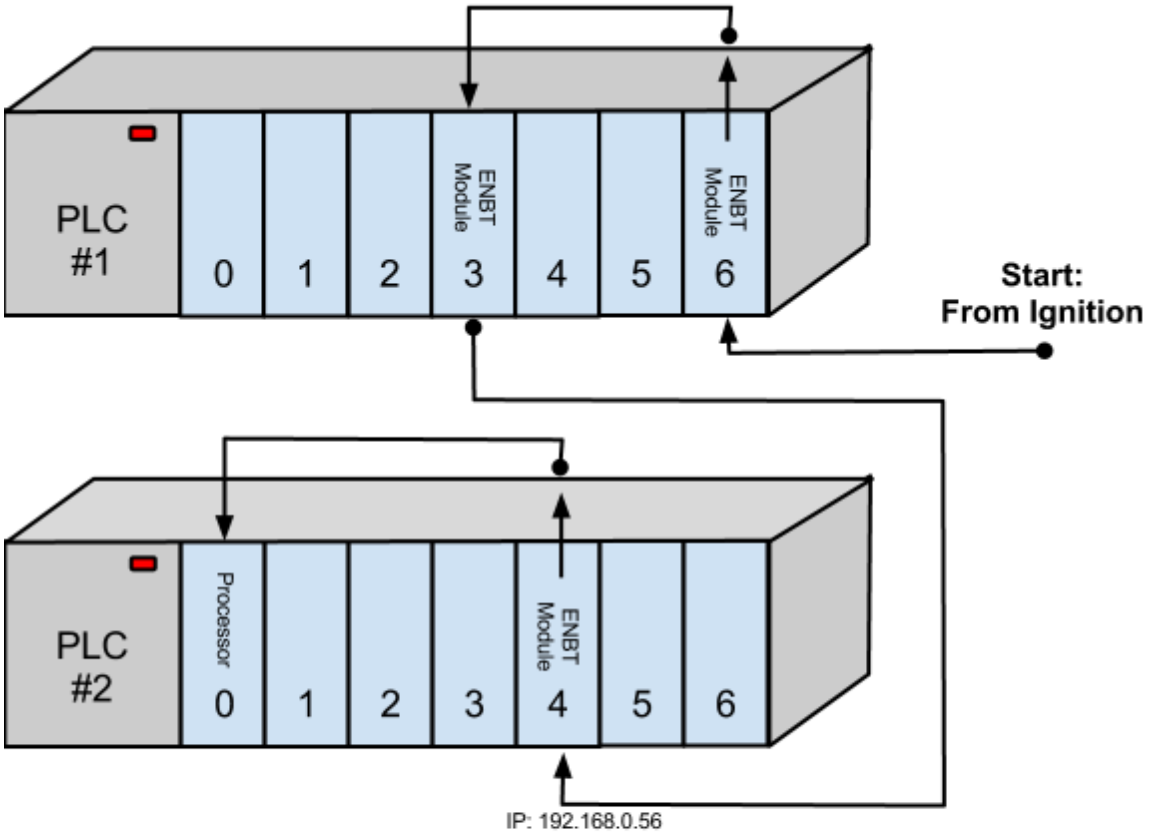

Walkthrough:
In from Ignition
Move out of ENBT to the backplane
Move to ENBT Module in Slot 3
Move out Ethernet Port
In ENBT Module @ IP Address 192.168.0.56
Move out of ENBT to the backplane
Move to the Processor in Slot 0

Connection Path: 1,3,2,192.168.0.56,1,0
1 = Backplane
3 = Slot 3, ENBT Module
2 = Ethernet Port
192.168.0.56 = IP Address of ENBT Module
1 = Backplane
0 = Slot 0, Processor

DHRIO Example

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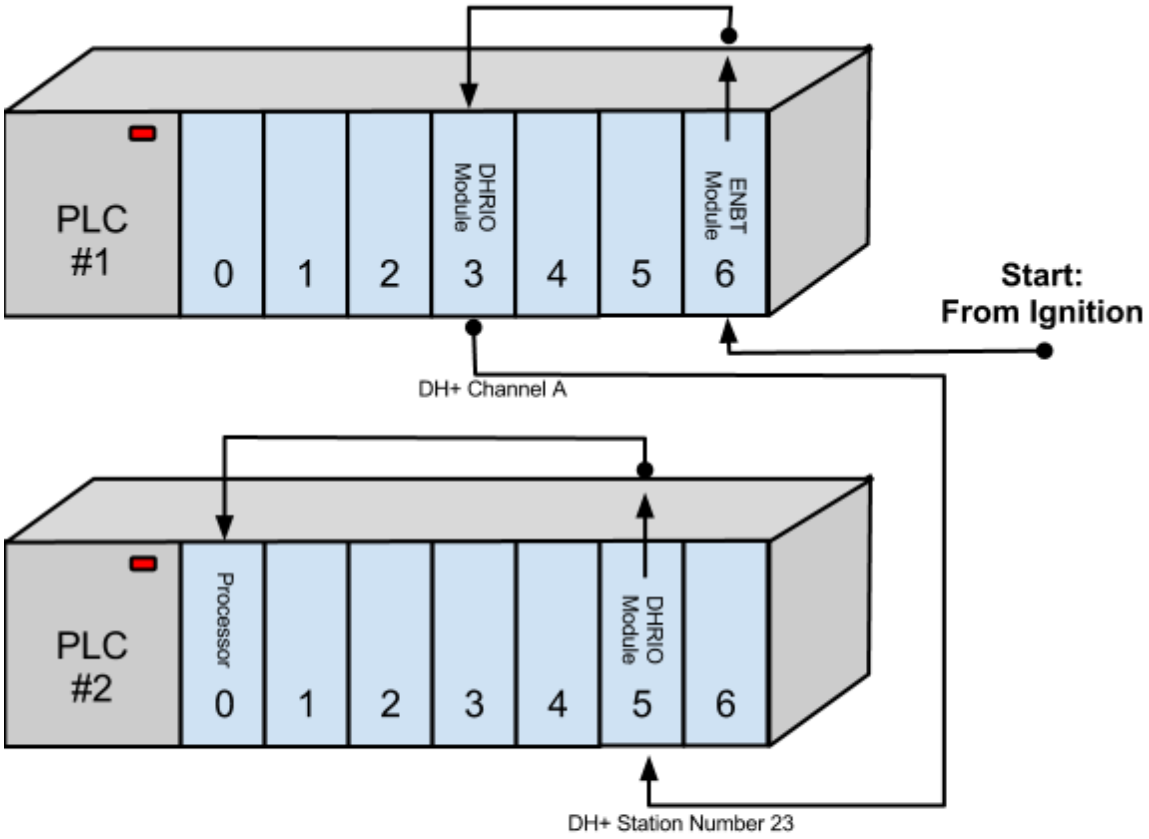

Walkthrough:
In from Ignition
Move out of ENBT to the backplane
Move to DHRIO Module in Slot 3
Move out DH+ channel A (2)
In DHRIO Module @ Station Number 23
Move out of DHRIO Module to the backplane
Move to the Processor in Slot 0

Connection Path: 1,3,2,23,1,0
1 = Backplane
3 = Slot 3, DHRIO Module
2 = DH+ Channel A
23 = DH+ Station Number
1 = Backplane
0 = Slot 0, Processor

ControlLogix Gateway -> SLC using DH+

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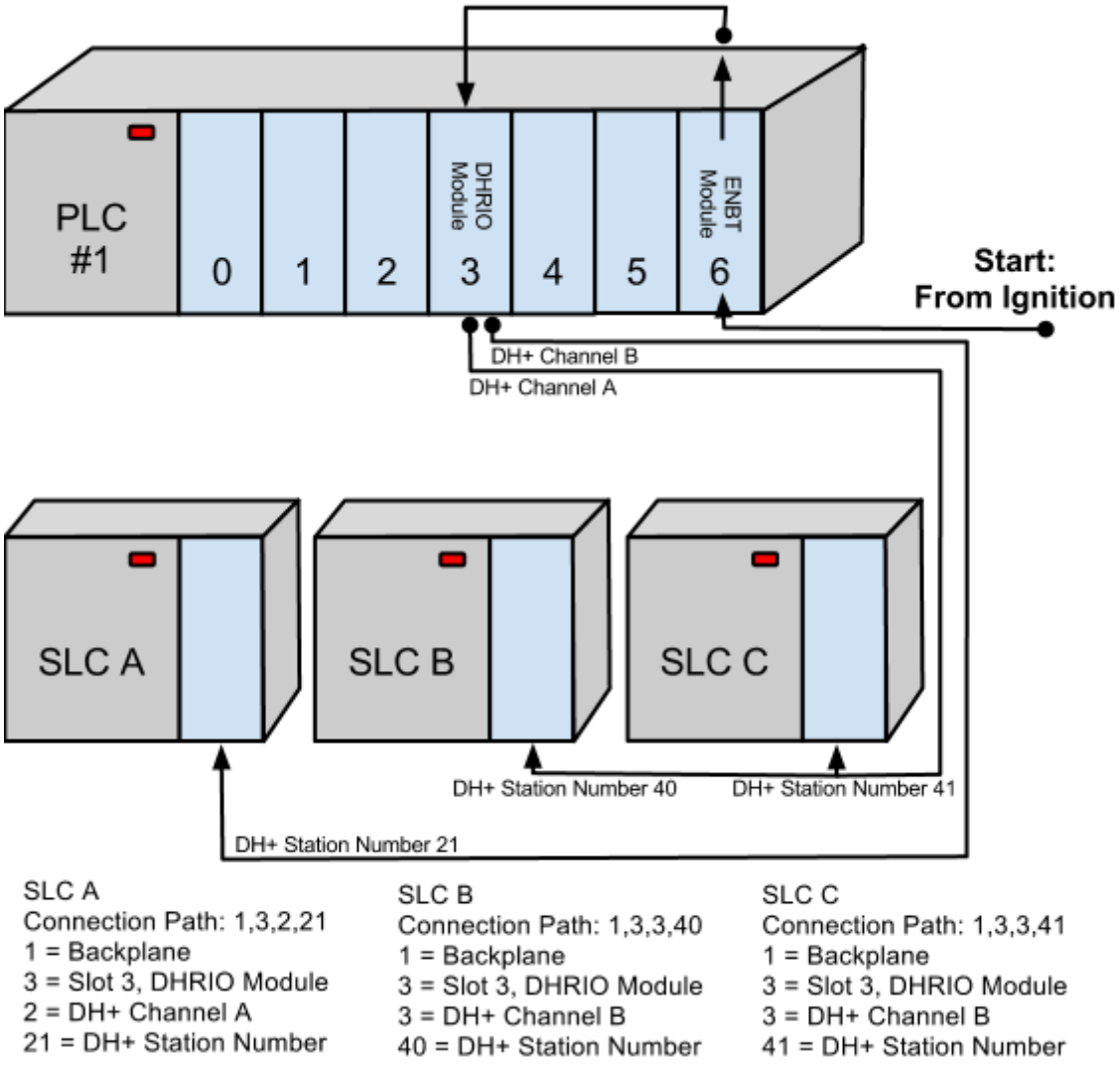

4.8.4.4.2 Simulator Drivers

4.8.4.4.2.1 Generic Simulator

The generic simulator provides a variety of tags that offer different data types and value generation styles. For example, there are ramps, sine waves, and random values. Additionally, there is a set of static writable tags whose values will persist while the device is running.

There are no configurable settings for the generic simulator.

Simulator tags

ReadOnly - static values that do not change for read only purpose

ReadOnlyBoolean1 - false

ReadOnlyBoolean2 - true

ReadOnlyShort1 - 1

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ReadOnlyShort2 - 2
ReadOnlyInteger1 - 1
ReadOnlyInteger2 - 2
ReadOnlyLong1 - 1
ReadOnlyLong2 - 2
ReadOnlyFloat1 - 1.1
ReadOnlyFloat2 - 1.2
ReadOnlyDouble1 - 1.1
ReadOnlyDouble2 - 1.2
ReadOnlyString1 - "ABCDEFG"
ReadOnlyString2 - "ZYXWVUT"

Writeable - static values that you can read/write to, initial values below
WriteableBoolean1 - false
WriteableBoolean2 - false
WriteableShort1 - 0
WriteableShort2 - 0
WriteableInteger1 - 0
WriteableInteger2 - 0
WriteableLong1 - 0
WriteableLong2 - 0
WriteableFloat1 - 0
WriteableFloat2 - 0
WriteableDouble1 - 0
WriteableDouble2 - 0
WriteableString1 - "" (empty string)
WriteableString2 - "" (empty string)

Random - Random values updating at some rate, they follow Java Random(rate) - rate is the seed
RandomBoolean1 - 10 sec
RandomShort1 - 5 sec
RandomInteger1 - 1 sec
RandomLong1 - 2 sec
RandomFloat1 - 10 sec
RandomDouble1 - 10 sec

Sine - Different sine waves with frequency, amplitude and offset (listed in that order)
Sine1 - 0.1, 100.0, 0.0
Sine2 - 0.01, 50.0, -25.0
Sine3 - 0.02, 10.0, 10.0

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Sine4 - 0.04, 100.0, 0.0

Sine5 - 0.08, 100.0, 0.0

Ramp - Ramp signals starting from 0 going up to some value at the specified rate. When they reach their upper limit, they are reset to zero.

Ramp1 - 0 - 100 @ 10 ms

Ramp2 - 25 - 75 @ 100 ms

Ramp3 - 0 - 100 @ 50 ms

Ramp4 - 0 - 100 @ 25 ms

Ramp5 - 0 - 100 @ 12.5 ms

Realistic - Values determined by adding a random number (between -1 and 1) to the current value.

Realistic1 - -50 - 50 @ 500 ms

Realistic2 - -50 - 50 @ 1000 ms

Realistic3 - -50 - 50 @ 1500 ms

Realistic4 - -50 - 50 @ 2000 ms

Realistic5 - -50 - 50 @ 2500 ms

4.8.4.4.2.2 Allen Bradley SLC Simulator

The SLC simulator driver creates a simple device whose address structure mimics a basic SLC structure. There are currently no configurable parameters.

4.8.4.4.3 Modbus Drivers

4.8.4.4.3.1 Modbus Ethernet

The generic Modbus driver allows the Ignition OPC-UA server to communicate with any device that supports Modbus TCP protocol.

The Modbus driver can connect directly to devices that support Ethernet communications. It can also connect to Modbus devices through a gateway. It is important to only add one Modbus device in the Ignition Device List per IP address. When communicating to multiple Modbus devices through a gateway each with a unique unit ID, either include the unit ID in the Modbus specific address or set it in the address mapping for the device. See below for more information of each method.

Properties

Hostname	The Hostname value is the IP Address of the Modbus device.
Communication Timeout	After sending a request to the Modbus device, the Communication Timeout setting is the amount of time in milliseconds to wait for a response before treating it as a failure.
TCP Port	The TCP port to use when connecting to a Modbus device. The Modbus TCP port specified in the Modbus specification is 502, but it can be changed to a different port.

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Maximum Holding Registers per Request	Some Modbus devices cannot handle the default of requesting 125 Holding Registers in one request. To accommodate this limitation change this setting to the maximum number of Holding Registers the device can handle.
Maximum Input Registers per Request	Some Modbus devices cannot handle the default of requesting 125 Input Registers in one request. To accommodate this limitation change this setting to the maximum number of Input Registers the device can handle.
Maximum Discrete Inputs per Request	Some Modbus devices cannot handle the default of requesting 2000 Discrete Inputs in one request. To accommodate this limitation change this setting to the maximum number of Discrete Inputs the device can handle.
Maximum Coils per Request	Some Modbus devices cannot handle the default of requesting 2000 Coils in one request. To accommodate this limitation change this setting to the maximum number of Coils the device can handle.
Use Zero Based Addressing	The Modbus specification states that Modbus addresses are to be zero based. Meaning Modbus addresses start at 0 instead of 1 and to read a value from Modbus address 1024, 1023 is sent to the device. When connecting to devices that do not adhere to zero based addressing, make sure this option is not selected. This will cause 1024 to be sent to the device to read Modbus address 1024.
Reverse Numeric Word Order	When reading and writing 32bit values from/to a Modbus device, the low word comes before the high word. By checking this option, the high word will come before the low word. The Modbus specification does not include a section for reading and writing 32bit values and as a result device manufacturers have implemented both methods.
Reverse String Byte Order	When reading and writing string values from/to a Modbus device, the low byte comes before the high byte. By checking this option the high byte will come before the low byte. If reading a string value from a device should read ABCD but BADC appears in Ignition then check this option.
Right Justify Strings	Strings stored in a Modbus device may contain leading spaces or trailing spaces. This can produce unwanted results so that Modbus driver removes spaces or zeros when reading string values. By default, left justify string handling will be used when reading and writing strings. By checking this option, right justify string handling will be used.

Modbus Specific Addressing

Per the Modbus protocol specification there are four basic types of addresses that can be read from a device. These include Holding Registers (read/write 16 bit words), Input Registers (read only 16 bit words), Coils (read/write bits) and Discrete Inputs (read only bits associated with device input points).

Modbus Specific Addresses can be manually entered into the OPC Item Path of an OPC Tag using the following designators followed by the Modbus address.

- `HR` for Holding Register
- `IR` for Input Register
- `C` for Coil
- `DI` for Discrete Input

Because some devices that support Modbus protocol store data in BCD format, there are two additional designators. These designators will convert the data from BCD format to decimal when reading data from

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the device and convert data from decimal to BCD when writing to the device.

`HRBCD` for Holding Register with BCD conversion

`HRBCD32` for 2 consecutive Holding Registers with BCD conversion

`IRBCD` for Input Register with BCD conversion

`IRBCD32` for 2 consecutive Input Registers with BCD conversion

To accommodate other data encoding commonly used by Modbus supported devices, the following designators are available for Modbus specific addressing.

`HRF` for 2 consecutive Holding Register with Float conversion.

`HRI` for 2 consecutive Holding Register with 32 bit integer conversion.

`HRUI` for 2 consecutive Holding Register with 32 bit unsigned integer conversion.

`HRUS` for Holding Register with 16 bit unsigned integer conversion.

`IRF` for 2 consecutive Input Register with Float conversion.

`IRI` for 2 consecutive Input Register with 32 bit integer conversion.

`IRUI` for 2 consecutive Input Register with 32 bit unsigned integer conversion.

`IRUS` for Input Register with 16 bit unsigned integer conversion.

To read or write string values from/to a Modbus device, the following designation is available for Modbus specific addressing.

`HRS` read or write consecutive Holding Registers as a string value.

Note that there are 2 characters for each word and the order of which character comes first is controlled by the Reverse String Byte Order device setting as described above. Because two characters are stored in a word, the string length must be an even number of characters.

```
HRS FORMAT: HRS<Modbus address>:<length>
```

Examples:

```
[DL240]HR1024 Read 16bit integer value from Holding Register 1024.
[DL240]HRBCD1024 Read 16bit BCD value from Holding Register 1024.
[DL240]IR512 Read 16bit integer value from Input Register 512.
[DL240]C3072 Read bit value from Coil 3072.
[DL240]IR0 Read 16bit integer value from Input Register 0.
[DL240]HRS1024:20 Read 20 character string value starting at Holding Register 1024.
```

The Modbus unit ID can also be specified by prepending it to the Modbus address. For example, to access Modbus unit ID 3 and read `HR1024` the full OPC path is `[DL240]3.HR1024`.

The Modbus specification does not support bit level addressing but it can be specified in the OPC Item Path. Please note that this only applies to reading bits of words and does not apply to writing bit values.

Example:

```
[DL240,bit=7]HR1024
```

Address Mapping

Because it can be very tedious manual entering OPC Tag information one-by-one, the driver has an

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address mapping feature. This allows entering blocks of common addresses and the driver will create the individual addresses and display them in the OPC browser.

Another benefit of address mapping is the addresses inside a device can have a different numbering scheme than the Modbus address. The Direct Automation DL240 is a perfect example of this. Address V2000, capable of holding a 16 bit integer, is Modbus Holding Register 1024. In addition, the DL240 addressing is in octal meaning there are no 8 or 9s. The sequence of addresses go: V2000, V2001, V2002, V2003, V2004, V2005, V2006, V2007, V2010, V2011.... V3777. This is not very straight forward.

Below details how to map the DL240 address range V2000 to V3777 in octal to Modbus Holding Register addresses 1024 to 2047. Also, notice the Radix setting that in this example being equal to 8 causes the addresses to be in octal (also known as base 8).

Note that mappings for string data types cannot be entered. Strings can only be read or written using Modbus Specific Addressing. See above for more details.

Once this mapping has been entered and saved, the OPC browser or the Quick Client will show all the DL240 addresses from V2000 to V3777 in octal.

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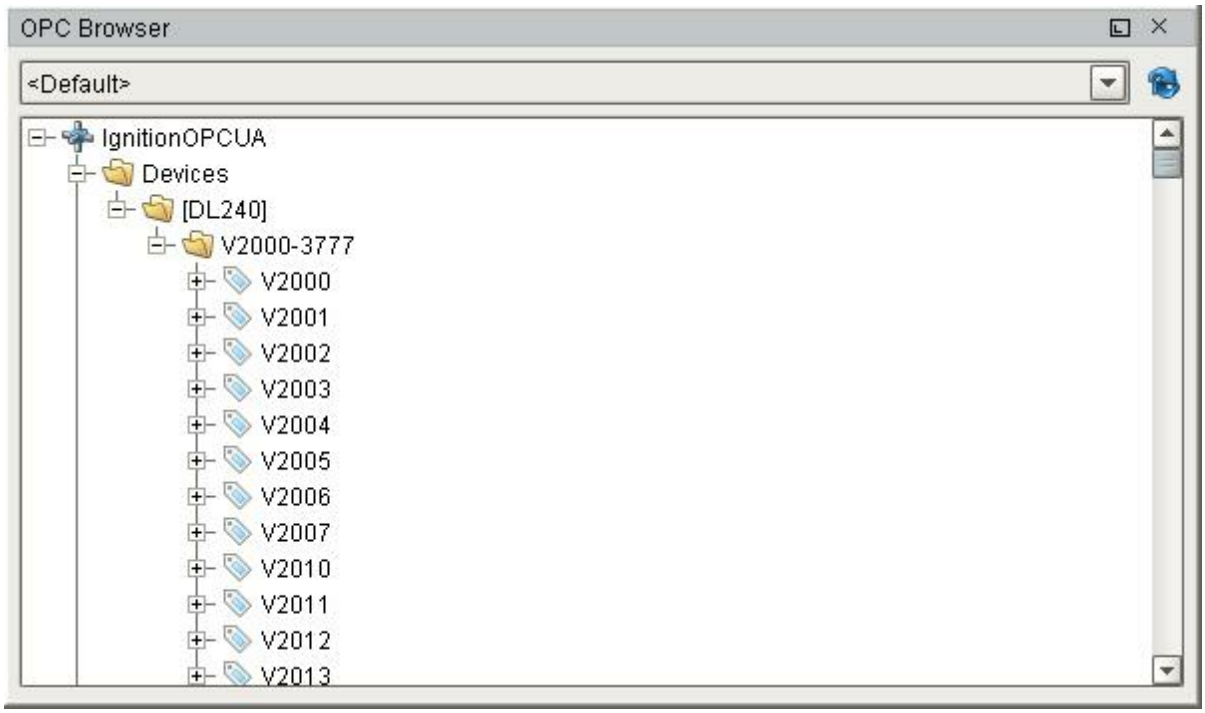

Example

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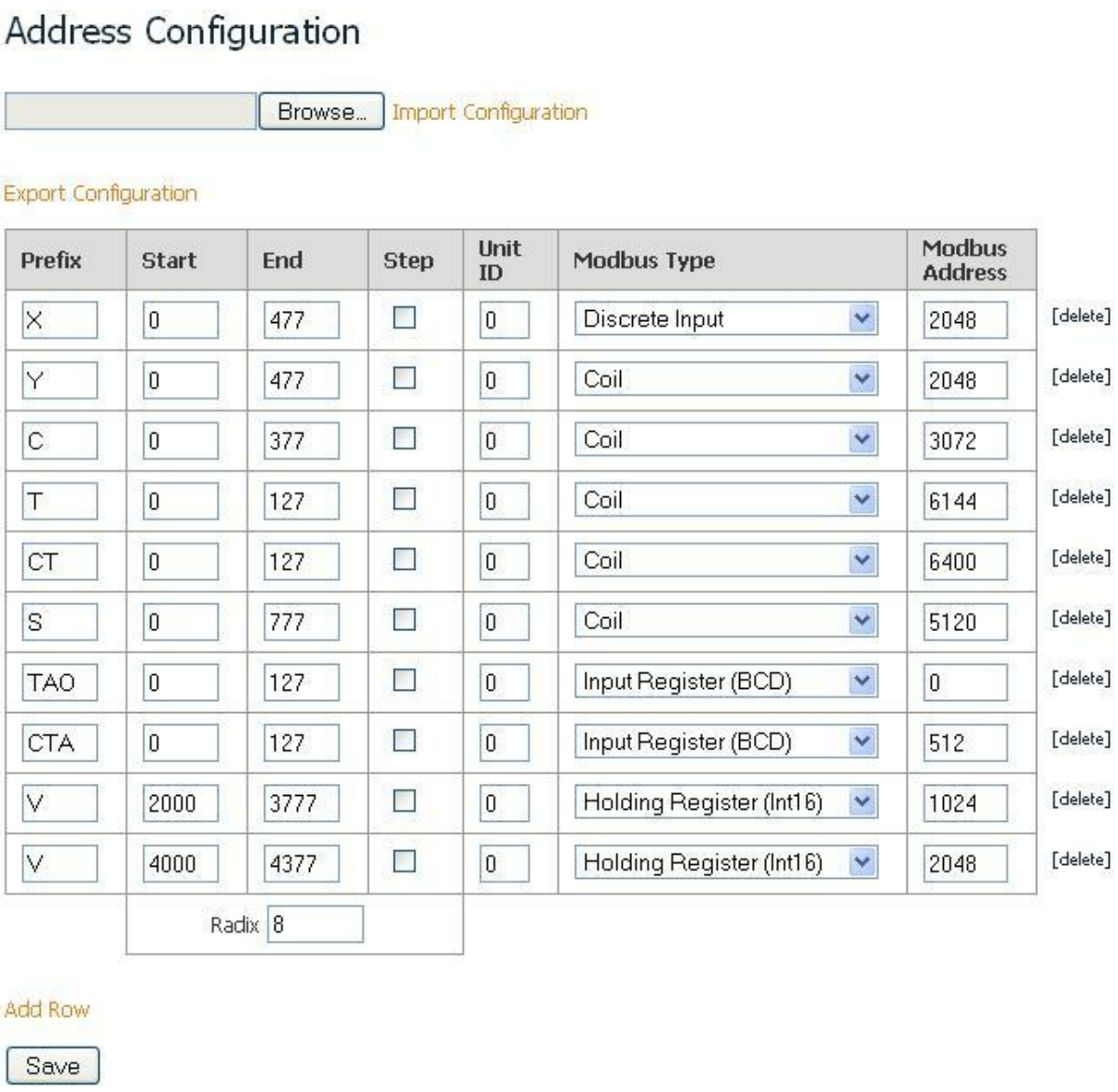
Address Configuration
Browse...
Import Configuration
Export Configuration
Prefix
Start
End
Step
Unit ID
Modbus Type
Modbus Address
X 0 477 0 Discrete Input 2048 [delete]
Y 0 477 0 Coil 2048 [delete]
C 0 377 0 Coil 3072 [delete]
T 0 127 0 Coil 6144 [delete]
CT 0 127 0 Coil 6400 [delete]
S 0 777 0 Coil 5120 [delete]
TAO 0 127 0 Input Register (BCD) 0 [delete]
CTA 0 127 0 Input Register (BCD) 512 [delete]
V 2000 3777 0 Holding Register (Int16) 1024 [delete]
V 4000 4377 0 Holding Register (Int16) 2048 [delete]
Radix 8
Add Row
Save

This shows mapping for all of the DL240 addressing.

When communicating to multiple devices through a Modbus gateway where the gateway only has one IP address, it is not recommended to add multiple Modbus devices with the same IP address. Only one Modbus device should be added to the Ignition OPC-UA Server device list for the gateway and to specify the different unit IDs in teh address mapping. The unit ID is specified for each entry in the address mapping for the Modbus device. Notice in the example address mapping below, that the Prefix, Start, End, Modbus Type and Modbus Address can be the same for two entries provided that the Unit IDs are different.

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Address Configuration

Browse... Import Configuration

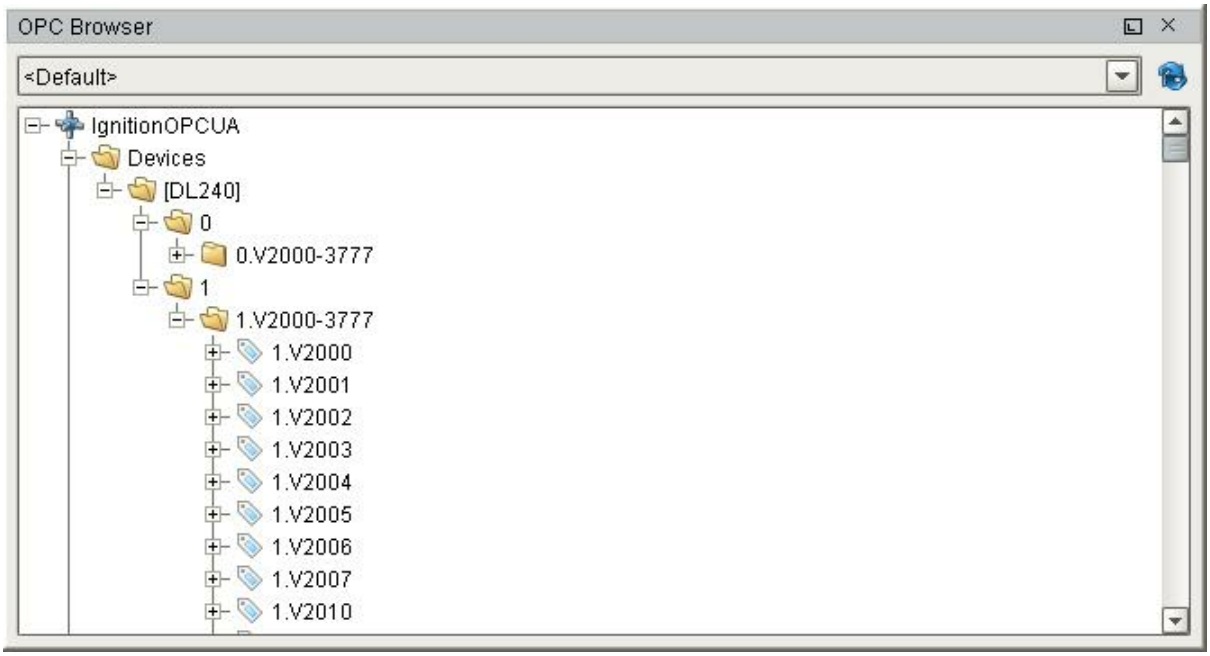
Export Configuration

Prefix	Start	End	Step	Unit ID	Modbus Type	Modbus Address	
V	2000	3777	☐	0	Holding Register (Int16)	1024	[delete]
V	2000	3777	☐	1	Holding Register (Int16)	1024	[delete]
	Radix 8						

Add Row

Save

Now when browsing the Modbus device, the unit ID will show as a folder and The OPC tag path will include the unit ID as shown below. This only happens when more than one unit ID is specified in the address mapping else the unit ID will be eliminated.



Modbus doesn't support reading and writing to any other memory types other than bits and 16 bit words. This is not very useful when reading from or writing to float point or 32 bit integers. To get around this the Modbus driver has been designed to read 2 consecutive 16 bit words and encode it into the desired data

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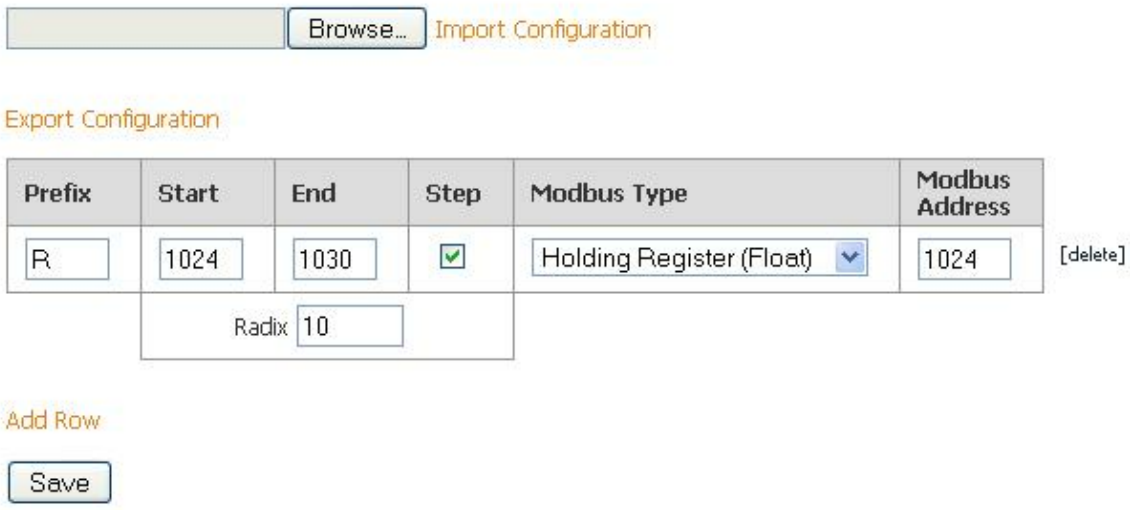
type.

The Modbus address mapping below details how to map float point addresses starting at 1024 and ending at 1030. With the Step check box selected, the addresses on the Ignition side will be index by 2. In this case R1024, R1026, R1028 and R1030 will be created.

Because the Modbus Type of Holding Register (Float) is selected, the driver will read two consecutive 16 bit words and convert it to a floating point value. It will also index the Modbus Address by 2 for each entry. In this case, R1024 will read from Modbus addresses 1024 and 1025 and convert them into a floating point value. When writing, the reverse of converting a floating point value into two 16 bits words is done before sending them to the device.



This shows what appears in the OPC Browser. Notice that the numbering is index by two and that it matches the Modbus address. With some devices, this will allow the addresses appearing in the OPC Browser to match the addresses in the device.

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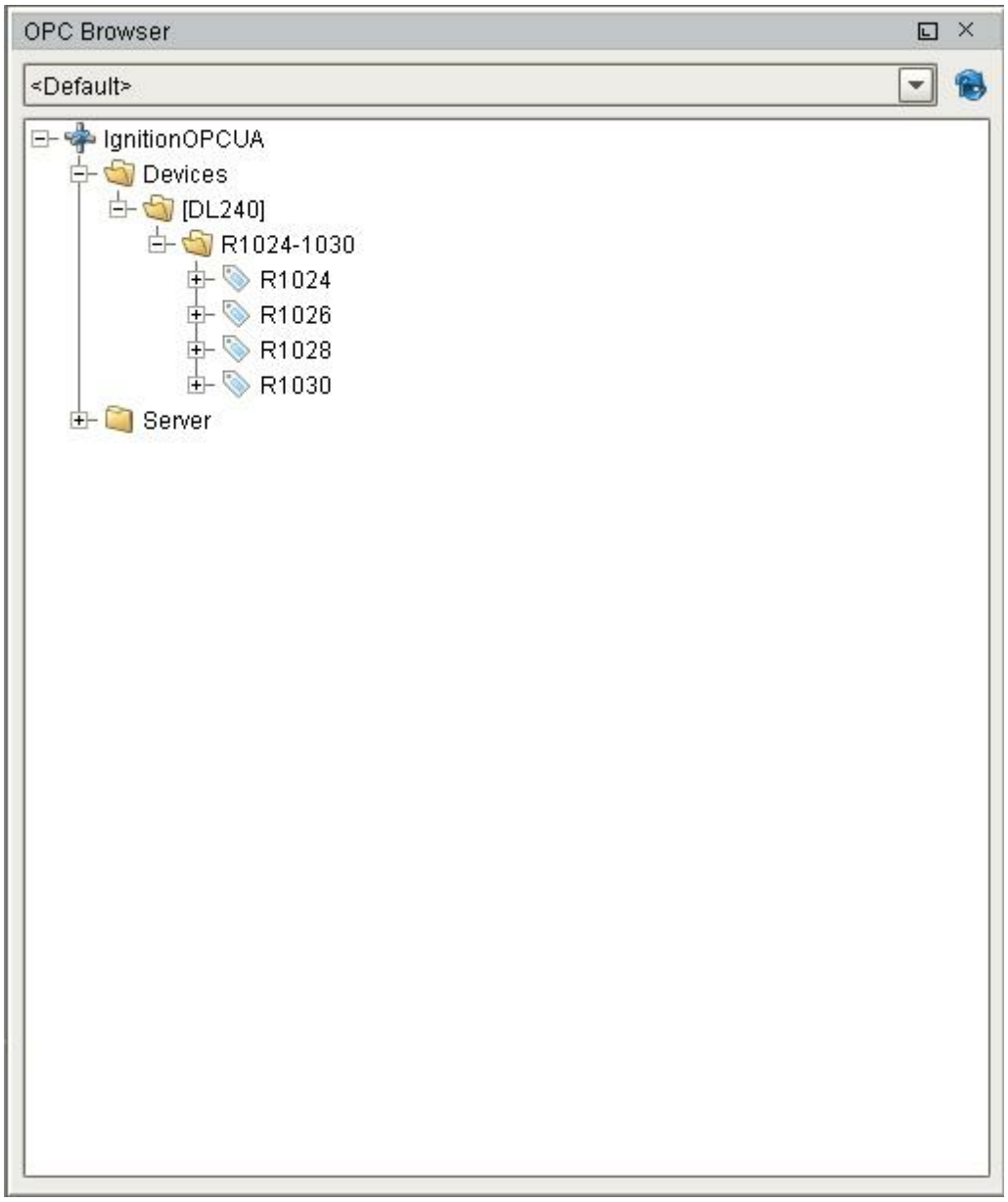

Import / Export Address Mapping

The mapping configuration can be exported to a comma separated values (csv) file. The csv file can later be imported in other Ignition installations or like devices.

4.8.4.4.4 UDP and TCP Drivers

4.8.4.4.4.1 UDP and TCP

The UDP and TCP drivers are strictly passive listeners. The UDP driver is configured to listen to one or more ports on a given IP address. The TCP driver is configured to connect to one or more ports on a given IP address.

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Rules are configured that dictate how the incoming data is interpreted.

Structure in the Address Space

A device using the UDP or TCP driver appears in the Devices folder of the OPC-UA server with the name it was configured to use. Browse the device will yield one folder per port configured to listen on.

Browsing the port folder will yield 1 variable node containing the entire message received as well as an addition variable node per field configured.

A device configured with a field count of 4 would have 5 nodes total - 1 for the message and 4 for the fields.

Properties

General

Device Name	The name to give to the device using this driver. This is will appear in the Devices folder when browsing the OPC-UA server.
Browse Timeout	Amount of time before a browse operation times out.
Read Timeout	Amount of time before a read operation times out.
Write Timeout	Amount of time before a write operation times out.
Enable Device	Whether or not this device is currently enabled. Disabled devices will not make a connection attempt.

Connectivity

Ports	On the UDP driver this will be the port(s) to listen on. On the TCP driver this will be the port(s) to connect to. Separate multiple ports with a comma.
IP Address	On the UDP driver this will be the IP address to listen to. On the TCP driver this will be the IP address to connect to.

Message

Message Delimiter Type	Sets the method used to determine how much or what data length constitues a full "message". Packet Based - Assumes that whatever arrives in one packet, regardless if length or content, is the message. Character Based - Content is appended to a message buffer until the given character arrives, at which point the contents of the buffer are considered the message.

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	Fixed Size - Content is appended to a message buffer until some fixed number of bytes is received, at which point the contents of the buffer are considered the message.
Message Delimiter	If the message delimiter type is "Character Based" then this shall be the character used to identify a message.
	If the type is "Fixed Size" than this shall be the size used to identify a message.
Field Count	The number of fields within a message must be fixed. This property dictates how many fields will be present in each message.
	When the number of fields received does not match the designated count all nodes will receive quality BAD_CONFIG_ERROR.
Field Delimiter	The character(s) that are to be used as field delimiters.
	For example, the message "a|b|c|d" with a field delimiter of "|" (no quotes) would be split into four fields: "a", "b", "c", and "d". The field count would have to be set at 4.

4.8.4.4.5 Siemens Drivers

4.8.4.4.5.1 Overview

The Siemens Drivers Module provides support for connecting to S7-300, S7-400, and S7-1200 PLCs via TCP/IP using the S7 protocol.

For more information on configuring tags see Addressing.

4.8.4.4.5.2 Addressing

The S7 protocol does not support browsing so all tags from the device must be configured as SQLTags in the Ignition designer. This can be done either manually, as needed, or by importing in bulk using the SQLTags CSV import functionality.

When creating a tag, the "OPC Item Path" field will be of the format: "[device_name]address", without the quotes, where device_name is the name given to the device during configuration and address is an S7 address, the format of which is described in the following text.

Tag addresses are made up of three different components: *Area*, *DataType*, and *Offset*.

Area	Syntax
DataBlocks	`DBn,`
Inputs	`I`
Outputs	`Q`
Flags	`M`
Timers	`T`
Counters	`C`

DataType	Syntax	Signedness
`Bit`	`X`	`N/A`
`Byte`	`B`	`Unsigned`
`Char`	`C`	`Signed`
`Word`	`W`	`Unsigned`

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DataType	Syntax	Signedness
Int	I	Signed
DWord	D	Unsigned
DInt	DI	Signed
Real	REAL	Signed
String	STRING or STRING.len	N/A

To form an address you combine the desired *Area* and *DataType* with an *Offset* into that area.

Examples:

```
      IB0               Byte at Offset 0 in the Inputs area.
      IW0               Word at Offset 0 in the Inputs area.
      DB500,DI8         DInt at Offset 8 in DataBlock 500.
      ISTRING24.50      A String of length 50 starting at offset 24 in the
Inputs area.
      IX20.3            Bit 3 of the Byte at Offset 20 in the Inputs area.
      T0                Timer at offset 0 (No DataType is specified for
Timers).
      C0                Counter at offset 0 (No DataType is specified for
Counters).
```

It is important to note that offsets are *absolute*. IW0 and IW1 share a byte. To get 2 consecutive, non-overlapping words you would need to address IW0 and IW2.

Bits

Bits are addressed by using the Bit *DataType* (X) and appending .bit to the end, where bit is in the range [0-7]. When addressing a Bit at a given offset, that offset is always treated as a Byte.

Strings

Strings are assumed to be in the S7 string format and have a max length of 210.

Timers

Timers are scaled up to a DWord and converted from S5 time format so they can represent the time in milliseconds without requiring any multipliers. When you write to a timer it is automatically converted from milliseconds into S5 time format for you. A *DataType* is not specified when accessing *Timers*.

Counters

Counters in the PLC are stored in BCD. The driver automatically converts to/from BCD for you and exposes any counter tags as UInt16 values. A *DataType* is not specified when accessing *Counters*.

4.9 SQLTags

4.9.1 SQLTags Configuration Overview

While the goal of SQLTags is to create an easy yet powerful tag model, the variety of options and terminology can sometimes make configuration confusing. The goal of this chapter is to provide a clear overview of the SQLTags landscape, and provide a clear guide to the configuration of various

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architectures. It will be useful to have a working knowledge of what SQLTags are and how they executed, described in the section What is a SQLTag? in the Project Design chapter.

SQLTags Providers and Drivers

At the highest level of configuration is the *SQLTag Provider*. A provider is a tag database (a collection of tags) and a name. An Ignition gateway can have any number of tag providers, and therefore the name is used to distinguish which provider a tag comes from.

Every provider holds tags, but not every provider is a SQLTag *driver*, or tag executor. Some tag providers simply make tags available to use, and the tag execution is performed by a different *driving provider* elsewhere. For example, the Database Provider is a SQLTag provider that simply watches a tag database stored in an external database. It does not execute tags, it only monitors the values of the tags present. Somewhere else there is a tag driver such as a Driving Datasource Provider or a legacy FactorySQL that is executing the tags and storing the values to the database.

Realtime vs. Historian Providers

As discussed above, all SQLTags reside in a tag provider and provide realtime values. Additionally, there is the concept of tag *historian* providers, which can store and query historical data for tags. Each tag can optionally have a historian provider assigned to it to whom it will report value changes for historical storage.

Realtime providers - Internal vs. External

The SQLTags "tag database", or how SQLTags tag configuration is stored, can take two forms. In the *external* form, tags are stored in a SQL database, outside of Ignition. For *internal* tags, the configuration is stored in the Ignition internal configuration file, next to windows, groups, etc. The two different storage mechanisms have different pro and cons, and so it is a good idea to acquaint yourself with each of them.

External SQLTags Providers

SQLTags were originally invented as a way to reliably bridge realtime status and control information through the database. Therefore, the external storage of SQLTags represents the original methodology, and in fact is why SQLTags have their name.

There are two possible external SQLTags providers in Ignition:

- Database Provider
- Database Driving Provider (provided by the SQL Bridge module)

The driving provider, as mentioned above, will execute tags as well as make available tags driven by other external drivers looking at the same database, such as other Ignition gateways using the driving provider, or legacy FactorySQL installations.

The primary benefit of external providers is that the data is stored in a central database, and is therefore accessible to other consumers besides just the local installation. In this way, it is possible to pull together data from geographically dispersed sites into a central location, and then make the data from each site available to all of the others.

The negative side to external providers is that all tag values must be written to the database and then polled for change, which is less efficient than holding them in memory as the internal provider does.

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Internal SQLTags Provider
As mentioned above, the internal SQLTags provider stores the tag configurations in the Ignition gateway. The tags cannot be accessed outside of that particular gateway, but in return the efficiency is much greater, as values do not need to be written to the database and polled. It is possible to create multiple internal providers per gateway.

4.9.2 Configuring Realtime SQLTags

Realtime SQLTags providers are configured in the gateway under `SQLTags > Realtime`.
After installation, the Ignition gateway will start with an internal provider defined. You can edit its name and settings by selecting *edit* to the right of its entry in the table, or create new providers by selecting *Create new realtime SQLTags provider* below the table.

4.9.3 SQLTags Realtime Provider Types

4.9.3.1 Internal Provider

The internal provider stores tags internally in the gateway, and executes them in memory. Static tag values are stored persistently, but otherwise no values are stored.

Settings

The internal tag provider only has one additional setting:

Default Database
The database connection that will be used anytime a tag needs to access the database, such as executing a SQL Query based Expression tag.

4.9.3.2 Database Provider

The *database provider* stores SQLTags in an open format in the specified database. This provider type **does not** execute tags- it simply models tags and monitors values driven by a different tag provider elsewhere, such as an Ignition gateway using the *database driving provider* or FactorySQL.

Settings

Database
The database connection where the SQLTags configuration is stored.

Poll rate
The rate (in milliseconds) at which to poll the tag database for changes in tag value or configuration.

Poll overlap
The amount of time to overlap polls by. If set to 0, the config scan will look for changes only since the last execution. However, on databases that do not support millisecond resolution or are performing less-than-optimally, this could result in missed changes. This setting will expand the window in order to avoid missing these changes.

4.9.3.3 Database Driving Provider

The *database driving provider* extends the *database provider* adding the ability to execute tags. The values will be stored to the SQLTags tag database in the specified database.

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Availability

The database driving provider is a feature of the SQL Bridge module. It is only available when the module is installed.

Settings

The driving provider shares most of the settings of the database provider. However, it adds some key properties for driving and browsing.

Driver name
The unique name of this driver. Since the tags are stored in a central database, there may be multiple providers and drivers operating on them. This name will be used to identify this driver instance, and the tags that it executes. While the driving provider will read all of the tags stored in the database, it will only execute those tags that are assigned to it.

Enable browsing (of OPC servers)
Allows remote browsing of the OPC servers available to this driver over TCP/IP. This allows other gateways to remotely browse and add tags assigned to this driver into the central database.

Browse port
The port to listen on for remote connections. This port must not be in use by any other entity on the machine. Also, each driving provider that wishes to support browsing must have its own port.

Browse address
The IP address/network name that remote gateways will use when browsing. Therefore, care must be taken that the address is available from the gateways that will try to connect. Also, since it is used for access by remote systems, it should *not* be the loopback address (*localhost* or 127.0.0.1).

The browse address and port will be stored in the SQLTags database so that other gateways can easily look them up. After the settings are configured, you should immediately see the driver name in the OPC browse list for the external provider on other systems looking at the same database.

Note: When using remote browsing, make sure that the local firewall has an exception for the port that is used to listen. Otherwise, remote machines will not be allowed to connect.

4.9.3.4 External Provider Reference

Important

The information provided here requires an understanding of SQLTags and how they work. It is an advanced reference to how the tables of external SQLTags providers are structured and an overview of the concepts of tag execution. If you are a new user it is suggested that you read the SQLTags section that resides in the Project Design area of the Ignition user manual first.

Basic Concepts and Data Flow

SQLTags operate through 9 tables created in the database.

Tag Configuration Tables

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1. **sqlt_core** - The core tag information table, has one entry per tag. Defines fundamental properties like data type, as well as the current value of the tag. Is monitored by the provider to determine value and configuration changes.
2. **sqlt_meta** - Provides additional properties for tags. Only consulted when tag configuration has changed.
3. **sqlt_as** - Provides alert state configuration for tags which utilize alerting.
4. **sqlt_perm** - Provides custom permission settings for tags set to use them.

Operations Tables

5. **sqlt_sc** - Contains the definitions of scam classes, which distate how tags are executed.
6. **sqlt_sci** - Contains an entry for each scan class from sqlt_sc, for each driver currently driving tags. Used to verify that drivers are properly executing.
7. **sqlt_drv -** Contains an entry for each SQLTags driver. Only really used for browsing tags.
8. **sqlt_err** - Contains errors that have occurred executing tags.
9. **sqlt_wq** - The "write queue". All write requests are entered into this table, where the driver will detect and execute them. The result will be written back by the driver, and will be noticed by the provider.

Tag Execution Concepts

Polling – Many operations require polling of the database by either the driver or the provider. To ensure efficiency, all polling operations utilize indexed timestamp fields. This allows the database to do very little work when nothing has changed.

Tag Configuration – Tags are configured by inserting or modifying the appropriate entries in the configuration tables above. Configuration change is signaled to the provider by updating the “configchange” of sqlt_core to be the current time. Deleting a tag works by setting it’s “deleted” column and then “touching” config change. This will inform all drivers and providers to remove the tag from memory. At some point later, a daemon will delete the tag information from the database.

Tag Execution, drivers – Each tag has a “drivername” property that indicates which driver is responsible for executing it. Other drivers and providers with different names will treat the tag as an “external” tag – a tag driven by a different entity – and will only monitor its value.

Tag Execution, scan classes – Each tag is assigned to a scan class. The idea is that scan classes will define how often the tag should execute, as well as provide more advanced options like leased and driven execution. In reality, the tag driver is free to execute tags as it desires, but it is important to understand how the scan classes and the sqlt_sci table are expected to work, as that is how the provider will verify that the tags are being executed.

Tag Monitoring – Both providers and drivers generally monitor tag value and configuration changes. In general, the entities will monitor tags whose “drivername” isn’t equal to their own, which for providers means all tags, since providers don’t have a driver name. Monitoring occurs by

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selecting the tag values (or any information desired) from the appropriate table where one of the indexed timestamp columns is greater than the last checked time. The provider/driver will then store that time in memory as the last check, and will use it in the next poll.

Table Reference

The following is a reference list for the table structures of all the tables listed above. In general, all integer time values are in milliseconds.

sqlt_core

Column	Data Type	Notes
id	integer	Auto-incrementing, unique id for the tag
name	string	Name of tag
path	string	Folder path, in form of "path/to/"
drivername	string	Name of driver responsible for executing tags
tagtype	integer / TagType enum	The type of tag - ie. OPC, DB, etc.
datatype	integer / DataType enum	The type of data provided by the tag
enabled	integer (0 or 1)	Whether the tag is enabled for execution
accessrights	integer / AccessRights enum	Access permissions for the tag
scanclass	integer	ID of the scan class for the tag
intvalue	integer	Value column used if tag has integer data
float value	double	Value column for float/real data
stringvalue	string	Value column for string data
datevalue	datetime	Value column for date data
dataintegrity	integer / DataQuality enum	Current quality of the value
deleted	integer (0 or 1)	Whether the tag is deleted or not
valuechange	datetime	The last time that the value changed
configchange	datetime	The last time that the tag's config changed

sqlt_meta

Column	Type	Notes
tagid	integer	ID of tag that the property belongs to
name	string	The well-known property name
intval	integer	Value, if property has integer type
floatval	double	Value if property has float type
stringval	string	Value, if property has string type

sqlt_as

Column	Data Type	Notes
id	integer	Unique id of alert state
statename	string	Name of alert state

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Column	Data Type	Notes
severity	integer / Severity enum	
low	double	Low setpoint
high	double	High setpoint
flags	integer / Alert Flags	Flags that dictate how the state acts.
lotagpath	string	Path to tag that provides low setpoint, if low driven flag is set
hitagpath	string	Path to tag that Provides high setpoint, if high driven flag is set
timedeadband	double	Time deadband value
timedbunits	integer / TimeUnits enum	Time deadband units

sqlt_perm

Column	Type	Notes
tagid	integer	ID of tag that the permission belongs to
rolename	string	Name of the role that this permission is applied to
accessrights	integer / AccessRights enum	Access rights for the given role on the given tag

sqlt_drv

Column	Type	Notes
name	string	Name of the tag driver
ipaddr	string	Address of browse server, blank or null if browsing isn't available
port	integer	Port of browse server

sqlt_sc

Column	Data Type	Notes
id	integer	Auto-incrementing unique id
name	string	Name of the scan class
lorate	integer	The slower rate to run at, in milliseconds. Only rate used if scan class mode is direct
hirate	integer	Higher rate, in ms. Only used if scan class is driver or leased
drivingtagpath	string	Path to tag to watch if mode is driven
comparison	integer / Comparison enum	Operation to apply to driving tag in driven mode
comparevalue	double	Value to compare driving tag to for driven mode
mode	integer / Scan class mode enum	The mode of the scan class
staletimeout	integer	Time, in milliseconds, before scan class is determined to not be running
leaseexpire	datetime	The time that the lease should expire, if using leased mode
configchange	datetime	The last time that the scan class has been modified

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Column	Data Type	Notes
deleted	integer (0 or 1)	Whether the scan class has been deleted

sqlt_sci

Column	Data Type	Notes
sc_id	integer	The id of the scan class represented
drivername	string	The driver executing this instance
lastexec	datetime	Last time that the scan class executed
lastexecrate	integer	The rate of the scan class at last execution
lastecexduration	integer	Time, in ms, that the scan class took to execute
lastexecopcwrites	integer	Writes to OPC performed during last execution
lastexecopcreads	integer	Value updates from OPC processed in last execution
lastexecdbwrites	integer	Writes to DB performed during last execution
lastexecdbreads	integer	Value updates from the database processed during the last execution
lastecexdelay	integer	The delay between when the scan class should have ran and when it actually ran for the last execution
avgexecduration	integer	The average duration time of the scan class, in ms
execcount	integer	The number of times the scan class has executed
nextexec	datetime	The next time that the scan class should execute

sqlt_wq

Column	Data Type	Notes
id	integer	Auto-incrementing unique id for the write operation
tagid	integer	ID of the tag to write to
intvalue	integer	Value, if tag has integer data type
floadvalue	double	Value, if tag has float or real data type
stringvalue	string	Value, if tag has string data type
datevalue	datetime	Value, if tag has date data type
responsecode	integer / Write Response enum	The state of the write request. When created, the response code should be set to 2 - Pending
responsemsg	string	Write error if operation failed
t_stamp	datetime	The time that the write request was created

sqlt_err

Column	Data Type	Notes
objectid	integer	ID of the object with the error
objectype	integer / Object Type enum	The type of object. Used with objectid to identify the item that caused the message
lifecycleid	integer / Lifecycle enum	When the message was generated
msgtype	integer / Message Type enum	

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Column	Data Type	Notes
errormesg	string	The primary message
stack	string	Additional error ingormation
t_stamp	datetime	When the message was generated

Enum Reference

Enums are well-known values that are stored as integers in the database

Tag Type

0	OPC Tag
1	DB Tag
2	Client Tag
6	Folder Tag

Data Type

0	Int1
1	Int2
2	Int4
3	Int8
4	Float4
5	Float8
6	Boolean
7	String
8	DateTime
9	DataSet

Data Quality

0	Bad Data from OPC
4	CONFIG_ERROR
8	NOT_CONNECTED
12	DEVICE_FAILURE
16	SENSOR_FAILURE
20	Bad, showing last value
24	COMM_FAIL
28	OUT_OF_SERVICE
32	WAITING
64	UNCERTAIN
68	UNCERTAIN showing last value
80	SENSOR_BAD
84	LIMIT_EXCEEDED

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88	SUB_NORMAL
28	SERVER_DOWN
192	Good Data
216	Good, with local override
256	OPC_UNKNOWN
300	Config Error
301	Comm Error
310	Expr Eval Error
330	Tag exec error (fsql)
340	Type conversion error
403	Access Denied
404	Not Found
410	Disabled
500	Stale
600	Unknown (loading)
700	Write Pending

Access Rights

0	Read Only
1	Read/Write
2	Custom

Scan Class Modes

0	Direct
1	Driven
2	Leased

Comparison Mode

0	Equal
1	Not Equal
2	Less Than
3	Less Than Equal
4	Greater Than
5	Greater Than Equal

Alert Flags

0x01	Low Exclusive
0x02	Low Infinite
0x04	High Exclusive
0x08	High Infinite
0x10	Any Change
0x20	Low Driven
0x40	High Driven

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Write Response	
0	Failure
1	Success
2	Pending

4.9.4 SQLTags Historian

4.9.4.1 How SQLTags Historian Works

SQLTags Historian gives you the ability to quickly and easily store historical data for your tags, and provides efficient querying of that data. Options for partitioning and deleting old data help ensure that the system stays properly maintained with minimal extra work.

This section describes various aspects of how SQLTags Historian stores and queries data.

Historian Providers

The settings for SQLTags Historian providers are set in the gateway under SQLTags > Historian. Historian providers are automatically created and removed according to the configured database connections. By default they will be created with a one month partition size, and will not delete old data.

Note: The standard tag historian features are added by the SQL Bridge module. If this module is not installed, the historian providers will not show up in the historian configuration section.

SQLTag Configuration and Historical Value Generation

The first step to storing historical data is to configure tags to report values. This is done from the Historian Properties page in the SQLTags editor in the designer. The properties include a historical scan class, that will be used to check for new values. Once values surpass the specified deadband, they are reported to the history system, which then places them in the proper store and forward engine.

Data storage

As mentioned, the historical SQLTags values pass through the store and forward engine before ultimately being stored in the database connection associated with the historian provider.

The data is stored according to its datatype directly to a table in the SQL database, with its quality and a millisecond resolution timestamp. The data is only stored on-change, according to the value mode and deadband settings on each tag, thereby avoiding duplicate and unnecessary data storage. The storage of scan class execution statistics ensures the integrity of the data.

While advanced users may change the table according to their database to be more efficient (for example, using a compressed engine), Ignition does not perform binary compression or encrypt the data in any way.

Table Partitioning
Ignition has the ability to automatically break up data into different tables of fixed duration. This can help make data maintenance easier, by preventing tables from becoming too large. Tables can easily be deleted in order to prune old data, and the database is able to better optimize access to frequently retrieved rows. The built-in partitioning feature can be used with any database.

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It is important to note the difference between this feature and any partitioning options that the database might provide. Most modern databases offer their own faculties for defining "partitions", offering similar and greater benefits. While Ignition cannot use these features directly, advanced users may choose to apply these features on top of what Ignition currently offers.

Data Compression
As mentioned above, Ignition does not perform any binary compression on the data. That is, values are stored directly in standard database tables. However, in order to reduce the number of values stored, Ignition offers two different algorithms for pre-compressing the data (trimming unnecessary values). The two modes correspond to the *value mode* property of the tag: Discrete, and Analog.

Discrete: The value uses a simple deadband, and is only stored when a new value is +/- the deadband value away from the previously stored value.

Analog: The deadband is used to form a corridor along the trajectory of the value. A new value is only stored when it falls outside the previous corridor. When this occurs, the trajectory is recalculated, and a new corridor formed.

See Historian Properties for more information about the difference between discrete and analog values.

Querying

While the data is stored openly in the database, the format does not lend itself well to direct querying. Instead, the Ignition platform offers a range of querying options that offer a tremendous amount of power and flexibility. In addition to simple on-change querying, the system can perform advanced functions such as querying many tags from multiple providers, calculating their quality, interpolating their values, and coordinating their timestamps to provide fixed resolution returns.

Querying can be performed on tables and charts through the Historical Binding, and through scripting.

4.9.4.2 Configuring SQLTags Historian

SQLTag Historian providers are configured at `SQLTags > Historian`. A historian provider is created automatically for each database connection, and will be removed if the connection is removed. Although enabled by default, the providers won't interact with the database unless data is logged to them.

General Settings

Enabled
Whether the provider will be turned on and accept tag history data. If disabled, any data that is logged to the provider will error out and be quarantined by the store and forward engine, if possible.

Data Partitioning

SQLTags Historian can partition the data based on time in order to improve query performance. Partitions will only be queried if the query time range includes their data, thereby avoiding partitions that aren't applicable and reducing database processing. On the other hand, the system must execute a query per partition. It is therefore best to avoid both very large partitions, and partitions that are too small and fragment the data too much. When choosing a partition size, it is also useful to examine the most common time span of queries.

Partition Length and Units
The size of each partition. The default is one month. Many systems whose primary goal is to show only recent data might use smaller values, such as a week, or even a day.

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Data Pruning

The data prune feature will delete partitions with data older than a specific age. It is not enabled by default.

Enable
Monitor the partitions and drop those whose data is older than the specified age.

Prune Age and Units
The maximum age of data. As mentioned, the data is deleted by the partition, and could therefore surpass this threshold by quite a bit before all of the data in the partition is old enough to be dropped.

4.10 Security

4.10.1 Users and Roles

Ignition uses the concept of *role-based security* throughout. Role-based security is the concept that each user may be assigned to various *roles*. Security policies are then defined in terms of these roles, rather than defined for specific users. This allows users to be reassigned, removed, and added without affecting the logic of the security policy.

The users and their roles are defined in *user sources.* An Ignition Gateway may have many different user sources defined, each governing the security of different aspects of the Gateway. For example, logging into the Gateway configuration web interface might be governed by one user source, while the security for a project is governed by another.

There are many different types of user sources that offer various features. For example, the *Internal* user source offers the ultimate in ease-of-use: you simple define the users, their passwords, and the roles within the Ignition Gateway configuration web interface. In contrast, the *Active-Directory* user source offers the power of integrating Ignition with a corporate security infrastructure. Users, passwords, and roles would be managed centrally by the IT department.

Security policies can be defined for many different parts of the system. For example:
You can alter the roles required to log into the Gateway *configuration section*
You can define roles required to write to or even read from a *SQLTag*
You can define roles required to view a *Component.*
You can access the security system in a *script* to restrict the operation of the script to authorized users.

Who Controls What?

With potentially multiple user sources defined, you need to understand which user sources are controlling which aspects of Ignition. To know what kind of user source is governing what, follow these simple steps:

1. To manage users and passwords for **logging into the Gateway Configuration section**, you'll need to see what user source is currently set as the Gateway's user source. You can check this under `Configuration > Gateway Settings` by looking at the *System User Source* field and the *Gateway Config Role(s)* field.
2. To manage users and passwords for **logging into the Designer**, you follow the same steps as in #1, except that you need to look at the *Designer Role(s)* field to see what roles are allowed to log into the designer.
3. To manage users and passwords for **logging into a Vision Client**, you go to the `Configuration`

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`> Projects` section. Look at the project in question and you can find its user source listed there.
4. Now that you know what user source you need to manage, you can find out what kind it is under the `Security > Users, Roles` section.

Contact Information and Schedules

User sources are also used for other aspects of the system besides security. For example, the alarm notification system also uses users from user sources to know who to send alarm notification messages to. For this reason, more information can be associated with a user. Contact info can be added to support the alarm notification system. A schedule can be defined on a user which can control when they are able to log in and receive alarm notification messages. Language preferences can be defined on a per-user basis to better support individual user's preferred language.

Managing Users

User sources support managing the users and roles from within Ignition to varying degrees. Some user sources are fully managable, meaning that you can administer the users, roles, contact info, etc from within the Ignition Gateway, as well as inside a Vision Client. Other user sources do not support this at all, while yet others only partially support it. Make sure you understand how and where the administration takes place before you choose a user source type.

For user sources that support it, you can manage the users and roles from within the Ignition Gateway's web config interface under `Configure > Security > Users, Roles`. Click on the "`manage`" link next to the user source you want to administer.

Often it is desirable to let some management or administrative users of a Vision project manage other users without having to log into the Gateway's configure section. To do this for a user source that supports being managed, you can simply use the built-in User Management Panel that comes with the Vision Module.

4.10.2 User Source Types

4.10.2.1 Internal User Source

The internal user source is very easy to use. This is the kind of user source that you get when you first installed Ignition and had the default user/password combination of `admin` / `password`. You can of course continue to use this "default" internal user source for your project(s), or you may choose to use other user sources instead.

The internal user source is fully manageable from within Ignition.

4.10.2.2 Database User Source

The database user source uses an external database connection to find its users, their passwords, and their roles. When you create a database user source, you have the option of setting it up in *automatic* or *manual* modes.

Automatic Mode

In this mode, the user source will create and manage the database tables for you. In this mode, the user source will be fully manageable from the Gateway and the Vision Clients using the user management component. You can specify a prefix for the tables that are created, but their names after the prefix are chosen by the user source.

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Manual Mode

In this mode, you must provide SQL queries for various functions of the user source. In this mode, the user source will *not* be manageable from the Gateway or the Clients. You'll have to manage the users yourself directly through the database. Examples for each of the queries are given on the user source setup page. Make sure to return the columns that are defined in each query's description.

4.10.2.3 Active Directory User Source

The active directory user source will communicate with a Microsoft Active Directory server through the LDAP protocol. Administration of the users and roles must be done through Active Directory's management tools. This user source is a good choice when integration with a corporate authentication scheme is a requirement.

To set up an active directory user source, you must specify the host that is acting as your primary domain controller. You can also use a secondary domain controller in case the primary is unavailable. You'll also need to specify the name of the domain and credentials for the Gateway itself to use for authentication for when it queries the list of roles.

This style of user source is *not* manageable within Ignition. You'll need to administer the users through Active Directory itself.

4.10.2.4 AD/Internal User Source

The active directory/internal hybrid profile type combines the internal user source type with the active directory user source type. Active Directory is used to find all of the users, and to check their credentials when they attempt to log in. However, it allows assigning of roles, contact info, and other meta-information about a user through Ignition, all of this information is then stored as if it were an internal user source.

This way, Active Directory can be consulted to see if a user is valid, but the management of roles does not require coordination with the I.T. department, who typically control the Active Directory system. This "best of both worlds" approach is popular for many users of Active Directory.

The AD/Internal hybrid user source is *partially* manageable. Users cannot be added or removed. Their usernames and passwords cannot be changed. This is because this information resides in Active Directory, not within Ignition. Other information, such as a user's roles, contact info, schedule, etc. *is* manageable.

4.10.2.5 AD/Database User Source

The active directory/database hybrid profile type is a combination of the active directory user source and the database (manual mode) user source. This means that for any username/password combination, active directory gets to decide whether that user is a valid user, and *if they are* considered valid, then the other information for that user (roles, contact info, etc) are retrieved from an external database connection.

Just like the AD/Internal user source, this is very handy for projects that are required to integrate with IT's centrally managed security, but negotiating the management of *roles* with IT would be too cumbersome. This user source is *not* manageable from within Ignition. Users/passwords must be administered through active directory, and roles, contact info, etc must be administered directly through the database.

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4.10.3 Enabling SSL Encryption

To enhance security in Ignition, you may opt to enable SSL encryption. This will affect all communication to and from the Gateway that is done over the HTTP protocol. This includes not only browsers interacting with the Gateway's web interface, but all Vision Client communication as well.

Turning on SSL will encrypt all data sent over HTTP. This protects your installation from anyone "snooping" the data as it passes over the network. This may be important if data transferred between the Gateway and clients is sensitive in nature. This also helps to thwart a security vulnerability known as "session hijacking".

To turn on SSL, navigate to the Configuration section of the Ignition Gateway's web interface. Use the left navigation menu to find the `Configuration > Gateway Settings` page. Here, check the "Use SSL" checkbox, and then press the "Save Changes" button.

After SSL is enabled, all clients and web browsers will be redirected to the SSL port if they try to use the standard HTTP port. By default, the SSL port is 8043. You may wish to change this to the standard SSL port of 443. To do this, follow the directions in Setting the Port.

4.11 Alarming

4.11.1 Alarming Overview

Alarming is a core feature of the Ignition platform. Alarms are conditions that are evaluated with respect to a specific numeric datapoint. Most commonly, alarms are configured on a tag or a Transaction Group item.

Any number of alarms can be attached to a datapoint. When the alarm condition becomes true, the alarm is considered to be "*active*". For example, on an analog tag you might add a high-level alarm that goes active when the tag's value is over 50.0. You could add another alarm onto the same tag for a high-high-level when the value is over 75.0. On a discrete tag, you might configure an alarm to be active when the value is non-zero. Each alarm has its own name, priority, and many other settings.

When the alarm condition becomes false after it has been true, the alarm is said to have "*cleared*". Each alarm has a numeric deadband and time delay deadbands that can affect when alarms go active and clear to prevent frequent oscillations of an alarm between active and clear when the value is hovering near the setpoint. At some point, an operator can *acknowledge* an alarm, confirming that they have seen the event.

The history of alarms is stored in any configured *alarm journals*. These will journal all state changes to each alarm, as well as acknowledgement, to an external SQL database of your choosing.

Information about configuring alarms can be found in Alarm Properties under SQLTag configuration.

4.11.2 Alarm Notification

Alarm notification is the act of sending a message to a group of people when an alarm becomes active or clear. In Ignition, this functionality is enabled by having the Alarm Notification Module installed. This functionality was introduced in Ignition 7.6, replacing the legacy "alert notification" system.

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Alarm Notification Profiles

A notification profile defines a delivery channel through which an alarm notification message may be sent to a user. The Alarm Notification Module comes with one-way and two-way email notification profiles. The one-way email notification profile simply sends an email containing the alarm notification message. The two-way email notification profile sends an email that contains links that allow that user to acknowledge the alarm(s).

Additional modules may be added to Ignition to enable more ways to send alarm notification messages. The Phone Notification Module adds the ability to notify users by calling them on the phone. The SMS Notification Module adds the ability to send text messages to users to notify them of alarms.

On-Call Rosters

An on-call roster is an ordered grouping of users. These are used as a way to group users together so that alarms can be sent out. Depending on the alarm notification profile used, the users may be notified one at a time (sequential), or all at once (parallel). You can create and manage on-call roster from the Gateway configuration page.

Schedules

The alarm notification system uses the user scheduling system that is built-in to Ignition. Alarm notification messages will only be sent to users whose schedule is currently active. When an alarm notification message reaches a notification block in a pipeline, that block's on-call roster will be used to find the users to notify. Of the users in the roster, only those users whose schedule is currently active will receive the alarm notification message.

Alarm Notification Pipelines

These pipelines define the logic of what should happen between an alarm becoming active (or clear), and people being notified. Pipelines are configured in the Designer, but you'll need to configure at least one alarm notification profile and at least one roster in the Gateway before you can configure a valid pipeline.

4.11.2.1 Voice Notification

The Phone Notification Module adds the ability to deliver alarm notifications to users via telephone, using any SIP compatible phone system. Messages are constructed in text, and are delivered through a high quality text-to-speech engine. The engine supports multiple voices and languages. Therefore, in order for the phone notification module to work, a compatible voice module must also be installed.

Core Features

Deliver voice calls through any SIP compatible phone system. No dedicated hardware required.
Messages generated by high-quality text to speech, and not a canned set of prerecorded files.
Supports multiple languages concurrently, based on user preference.
Allows users to acknowledge events.
Supports requiring a personal identification number for additional security.
Ties into the audit log to audit call events, successful message delivery, and user acknowledgements.
Supports message consolidation.

About SIP and VOIP

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The Session Initiation Protocol, is a highly popular specification for implementing Voice Over IP (VOIP) based phone systems. The protocol itself, as the name suggests, is responsible for initiating communication sessions, and then other protocols such as SDP and RTP are used to actually transfer voice data. Ignition has these protocols built in,

SIP is a peer-to-peer protocol, where one side talks directly to the other. However, it is possible to have gateways that repeat and route data between the two parties. Sometimes phone calls on VOIP networks stay purely in software, but often a gateway will transition the call to a traditional phone line.

By leveraging SIP, Ignition can call physical phones, soft phones, be worked into more complex PBX schemes, while avoiding the high cost of traditional, dedicated voice cards. To get started, though, you'll need some sort of SIP gateway. Asterisk is a popular, open source, system that is used by thousands of companies worldwide. If you simply want to connect to a phone line, the Atcom IP01 FXO box is a low cost device that runs Asterisk.

Gateway Configuration

To get started with voice notification, add a new profile by going to Configure -> Alarming -> Notification in the Ignition gateway. You are only required to specify the host address of the SIP gateway, though depending on the gateway, you may be required to enter a username and password.

There are additional settings that dictate how calls are managed, such as timeouts for answering, and the maximum amount of time that a call can take. Additionally, you can choose to link the notification profile to an audit profile in order to record important call lifecycle events.

After saving the profile, you should see the status update from "Unknown" to "Registered", indicating that the gateway has successfully registered with the SIP gateway. If you see an error, verify that the settings are correct, and that the username and password are correct. The system log console can also be useful in determining what is wrong.

Note: If you receive errors indicating that an "invalid parameter" has been used, try setting the local and public bind interface settings under the advanced options. These should be set to the IP address of the network card that is being used to communicate with the SIP gateway. On some systems, especially Linux hosts, the default empty values result in this error.

Using Skype

If you don't have an existing VOIP system in place, using a hosted service is the quickest way to get going with the voice notification module. Skype offers SIP based service through their Skype Connect product. To get started, you must have a business account, which provides you access to the Skype Manager. From there, you can create a new Skype Connect channel. For more information, visit http://manager.skype.com

Once you have created a Skype Connect channel, configuration in the gateway is similar to that of any other PBX system. The host will be "sip.skype.com", and the user name and password will be those provided by skype during the registration process. Note: while skype allows to you specify how many "channels" may be used, Ignition currently only supports one channel at a time.

Configuring Messages

The message played to the user during the phone calls is defined in the call script. The script dictates the overall structure of the call, defining the phrases and options, and the possible responses. The

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messages for each alarm are built off of a message template that can reference properties in the alarm. The script can be edited by selecting “manage scripts” next to the voice notification profile. Note: Although the link appears next to a particular profile, the scripts are shared across all voice notification profiles.

The role of each phrase in the script is explained on the settings page. Some parts of the script, such as the phrase requesting the user’s PIN number, will only be used if certain settings are configured on the notification block in the pipeline (in this case, the setting to require a PIN). As previously mentioned, the alarm message (for both active and clear) can reference any property of the alarm. The default message looks like this:
At {eventTime|hh:mm:ss}, alarm named {name} became {eventState} with a value of {eventValue}

In this case, the message refers to the alarm name, the eventState and eventValue (note: eventState is different than state. Event state is just the transition that triggered the alarm, such as “active”, whereas “state” is the full current state, such as “active, unacknowledged”), and the eventTime. Notice that the event time is formatted to only use the time, and not include the current date.

Scripts can be created for different languages. When the system attempts to deliver a notification, it will look to see if the target user has a preferred language. If so, and the language has both a script defined, and a compatible voice installed, the user will be notified in that language.

Note: Alarms also allow you to define a custom message, relevant to that particular state. If a custom message is defined, it will be used instead of the default message in the script.

The Call Lifecycle

A call is initiated when an alarm event enters the notification profile block in a pipeline. When this occurs, the target users are collected, based on the defined call roster, and the current schedule. Only users who have phone contact details defined will be selected for phone notification.

The voice system can only call one number at a time, and so it takes the first contact off of the queue and initiates the call. The user is given up to the “answer timeout” to answer. After picking up, the user will be asked to enter their pin number, or press any number to continue. The call is not considered “answered” until this action occurs, so the message will be repeated until the answer timeout expires. By acting in this way, the system is able to confirm that a human has actually answered, and the call will then be audited as successful.
Once past the initial challenge, the user will then hear the alarm messages. After each message, they will be asked to either acknowledge, ignore, or repeat the message. Selecting “acknowledge” will cause the alarm to be acknowledged in the alarming system, likely causing it to drop out of the alarm pipeline (dependant on pipeline settings). Ignoring the alarm indicates that the user has heard the message, but cannot or does not want to acknowledge the alarm.

Once the call has completed, the notification system will check the alarm events against the pipeline fallout conditions, and move on to the next call. The system will cycle through all alarms and all contacts (and all phone numbers for each contact) until everyone has been notified, or the pipeline settings have caused all events to drop out.

Pipeline Configuration

The voice notification system is accessed through the Notification Block in the Designer's pipeline configuration, like all other notification methods. As with other methods, you select a call roster, and can optionally turn on consolidation. There are only two options which can be set on the notification block:
Require PIN: If selected, the user will be required to enter their personal identification number in order to hear the message. The user’s PIN number is specified on their profile in the user management system. If

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false, or if the user does not have a PIN specified, the user will only be required to press any key to continue.
Allow Acknowledgement: If true, the user will be given the opportunity to acknowledge the alarm. If false, they will only be able to hear the alarm and continue.

4.11.2.2 SMS Notification

The *Airlink Sms Notification Module* gives users the ability to deliver SMS alarm notifications via an Airlink Raven XE cellular modem configured with a SIM card belonging to an active cellular account. If enabled, recipients of these messages can reply with a special code in order to acknowledge the alarm.

Gateway Configuration

To create an SMS notification profile, go to Configure -> Alarming -> Notification in the Ignition gateway, select "new profile", and select the appropriate profile type. Enter the relevant details concerning your device, and save the profile. The *Airlink Address* and *Send Port* are configured in the device, and the *Receive Port* is the port used by Ignition when two-way messaging is enabled. Therefore, the port must not already be used by the host system, and must not be blocked by a firewall.

Two-way Messaging
If enabled, the message recipients will be able to acknowledge alarms by replying to the SMS messages received. This is communicated to Ignition via UDP data sent from the modem. Therefore, the Airlink modem must be configured with the IP address of the system.

Device Configuration

Basic configuration of the Airlink modem can be accomplished by importing a template settings file provided by Inductive Automation. The only settings that must be configured manually are the IP Address of the device, and that of the reply target, when using two-way messaging.

Multiple Systems with One Modem

It is possible to use one SMS modem with multiple Ignition systems for one-way messaging. Only one system can receive responses for two-way messaging.

4.11.3 Alarm Journal

An *alarm journal* stores historical information about alarms in a database. It can store basic data about alarms that have occurred, such as their source and timestamp, along with associated data on the alarm, and the values of the alarm's properties at the time the event occurred. The alarm journal is used by the Alarm History Component, and can be accessed through scripting functions and direct database queries.

Creating a new Alarm Journal

Alarm journals can be created by going to Alarming>Journal in the Ignition gateway, and selecting "Create new...". The only required setting is the Datasource, which must be a valid database connection.

Filtering Settings
The *minimum priority* and *store shelved events* options filter what time of alarm events are stored in the

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journal. "Shelved" events are alarms that have been temporarily silenced by operators. Though they are not displayed to users, these events continue to be generated, and can be stored if the journal settings permit it. When stored, they will have a special flag indicating that they were shelved at the time.

Use Store and Forward
If enabled, the alarm events will go through the Store and Forward system. This system protects data from being lost due to temporary database connectivity issues.

Event Data
Alarm events consist of two main types of data: the primary information about the alarm, such as transition state, time, etc, and the "event data". These settings specify what type of event data is stored:

Static Config - Alarm properties that are not bound. These do not change during evaluation, only when a user modifies them in the designer, and so they are not stored by default.
Dynamic Config - Alarm properties that are bound. The value of these properties can change at any given time, and the values at the time of the alarm are captured on the alarm event.
Static Associated Data - Associated Data (properties created by the user) that are not bound, and do not change during execution.
Dynamic Associated Data - Associated Data that is dynamically bound.

Data Pruning
If enable, the system will periodically delete data older than the specified timeframe. Note that since the data is stored directly in a database, an administrator is free to manually delete data at any time.

Advanced Properties - Table Names
These settings allow you to specify your own table names. This is especially useful when trying to use multiple alarm profiles within a single database (not common, but can happen, especially with multiple systems sharing a single database).

Table Definitions

The alarm journal system will automatically create the necessary tables for you, and scripting functions can be used to query the system without having to know about the table structure. However, understanding the structure of the alarm journal tables can be useful for accessing the data in situations where SQL queries are more convenient.

Alarm Events (alarm_events)
This table stores the core data for each event that occurs. An event is a transition for an alarm between active, cleared, or acknowledged. Additionally, other events may be stored in this table that aren't directly related to an alarm, such as a system shutdown event. This table defines a primary key "id", that is used as a foreign key by the Alarm Event Data table, which stores additional information for each event.

Column Name	Data Type	Description
id	integer	A unique integer id for each event entry.
eventid	string	The UUID of the alarm event that this individual event is related to. Each "alarm event" (one particular active/clear/ack cycle of a defined alarm) receives a unique id in order to distinguish it from other events from the same source.
source	string	The *qualified path* of the entity that generated the alarm event. See below for more information about qualified paths.
display path	string	The value set for the "Display Path" of the alarm. Generally a user defined, friendlier version of the source.
priority	integer	The priority or severity of the alarm:

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		0: Diagnostic **1**: Low **2**: Medium **3**: High **4**: Critical
eventtype	integer	The type of transition represented by this event: **0:** Active **1:** Clear **2:** Acknowledgement
eventflags	integer	A numeric bitmask flag field providing additional information about the event. **Bit 0**: System Event - See below for more information **Bit 1**: Shelved Event - The alarm was "shelved" at the time that the event occurred. Shelving alarms does not prevent execution, so if the journal is configured to store shelved events, they will be stored even if they're not sent to the notification system, or shown to users. **Bit 2**: System Acknowledgement - When the "live event limit" (defined in general alarm settings) is exceeded, the system will automatically acknowledge overflow events, and the acknowledgment event will have this flag set.
eventtime	datetime	The time of the event.

Alarm Event Data (alarm_event_data)
This table stores the properties associated with an alarm event. The individual event is referenced through the "id" column, against the alarm event table.

Column Name	Data Type	Description
id	integer	The id that corresponds to the alarm event in the alarm_events table.
propname	string	The name of the property. May be one of the common alarm properties (a configuration setting), or the name of an associated data property.
dtype	integer	The data type of the property, indicating which data column should be used: **0:** Integer **1:** Float **2:** String
intvalue, floatvalue, strvalue	integer, float (double), string	The corresponding value columns for the property. Unused columns will receive "null" values.

Note: Although the dtype column indicates which data column should be used, since null will be stored in the unused columns, using "coalesce(intvalue, floatvalue, strvalue)" provided by most databases is an effective way to query the value.

About System Events
System events are stored in the journal to record actions that aren't directly related to a particular alarm. Currently the following events are stored:

- System Startup
- System Shutdown
- Alarms Shelved
- Alarms Un-shelved

Qualified Paths
A *qualified path* in Ignition is a path to an object, described by various annotated components. Each component has a type identifier, and a value, separated by a colon (":"), and each component is separated by colon-foward slash (":/"). For example, an alarm is identified by "alm:Alarm Name". It usually exists under a tag, in which case it's fuller path would be "tag:Path/To/Tag:/alm:Alarm Name".

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Paths can be built up further depending on the level of specificity required by the situation.

4.11.4 Schedules

Schedules define times of availability and unavailability. The built-in "Always" schedule is a schedule that is simply always active. Defining new schedules is easily done through the Gateway's configuration web interface. Schedules can also be administered inside a Vision Client by using the Schedule Management Panel component.

Defining a Schedule

Each schedule is defined by which days of the week it is active for, and during what times. Schedules can also be defined with repeating patterns that repeat either weekly or daily. When defining time ranges, use 24-hour format and commas to break up different spans. For example, to if you want the schedule to be active from 8am-5pm with a 45 minute break starting at noon, you'd use: `8:00-12:00, 12:45-17:00`

For Alarm Notification

Schedules are always used by the alarm notification system. When an alarm notification pipeline reaches a notification block, it looks at all of the users defined in that block's configured *on-call roster.* Only those users whose schedules are currently active will be notified. This way, you can group people in call rosters by role, not by shift. For example, suppose you have alarms that should be sent to all supervisors. You can put all of the supervisors in one call roster, and the scheduling system will automatically only notify those supervisors who are on-shift when the alarm goes active.

For Restricting Login

Schedules may optionally be used to restrict users' ability to log in. To enable this, check the "Schedule Restricted" option on the user source in question. That user source will then reject logins for users whose schedule is inactive, even if their credentials were accurate.

4.11.5 On-Call Rosters

An On-Call Roster (often simply called "roster" for short) is simply a group of users in a specific order. Rosters are used for alarm notification. Alarm pipelines' notification blocks must choose an on-call roster which defines the users to notify for that notification block.

It is important to remember that when an on-call roster is used for alarm notification, only those users on the roster whose schedules are active will actually be notified.

You can define rosters via the Gateway's web configuration interface under `Configure > Alarming > On-Call Rosters`. Adding users to the rosters is done via picking a user source, and then dragging the users into the roster. Once in the roster, you can drag them up and down to define the order.

Roster management can also be exposed to users inside a Vision Client by using the Roster Management Panel component. This component can re-arrange and add/remove users to any defined roster.

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4.12 Redundancy

4.12.1 What is Redundancy?

Redundancy is an advanced feature of Ignition that provides a higher degree of fault-tolerance and protection from downtime due to machine failure. Using redundancy, two Ignition installations can be linked together, so that when one fails, the other takes over and continues executing. All of the clients connected will be redirected to the backup machine, and historical data will continue to be logged.

There are a variety of design decisions that come into play when setting up redundant systems, so it is important to understand the available options, and how the pieces of the system function in a redundant setting. This chapter will start with key terminology that will be used heavily, and will then proceed to explain how the main parts of the system function. It will then explain the various settings available, and will finish up with an examination of a few common setups.

Clustering vs. Redundancy, and previous versions of Ignition

Previous versions of Ignition contained a feature called *clustering* that was similar to redundancy in that it linked multiple systems, but different in terms of the goals it aimed to achieve. The primary goal of clustering was to provide a seamless platform for balancing many client connections across multiple servers. In the reality of the field, it was observed that client load was rarely a cause for concern. Ease of configuration and greater flexibility in creating redundant fail-over systems were larger concerns, and resulted in the switch to "redundancy".

Terminology

Here are some of the most common terms used in relation to redundancy.

Activity Level
The activity level describes what the Ignition installation is currently "doing". A node in a redundant pair will operate at one of three levels: Cold, Warm, or Active. In "cold", the system is doing a minimal amount of work. In "Warm", the system is nearly running at full level, in order to switch over quickly. Both of these levels imply that the other node is currently active. In "active", the system is the primary system, responsible for running all sub-systems.

Node
A node is an Ignition installation, set to be part of the redundant pair. There can be a master node, and a backup node.

Active Node
The active node is the Ignition installation that is currently at the "active" level, and is responsible for running. It is also described occasionally as the "responsible node". It can be either the master or backup node, even when both are available. For example, if the backup node becomes active after the master node fails, and the master comes back up but is set to *manual recovery mode*, the backup will continue to be active until it fails or the user switches responsibility back to the master.

Master Node
The node that is responsible for managing the configuration state. It is also generally expected to be the active node when available, though this is dependent on settings. It is therefore import to separate the ideas of the *master node* and the *active node.*

Backup Node
The node that communicates with the master and takes over when that node is no longer available.

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4.12.2 How Redundancy Works

Ignition redundancy supports 2-node systems. One node is considered the **master node**, and the other is the **backup node**. Both nodes share the same "state", or configuration. In other words, all projects, gateway settings, etc. are shared between the nodes. The management of the configuration is performed by the master node, and then replicated to the backup node.

Node Communication

The master and backup nodes communicate over TCP/IP. Therefore, they must be able to see each other over the network, through any firewalls that might be in place. All communication goes from the backup to the master node, by default on **port 8750**. Therefore, that port must allow TCP listening on the master machine. The port can be changed in the gateway redundancy settings page.

Configuration Synchronization

The master node maintains the official version of the system configuration. All changes to the system must be made on the master- the gateway on the backup will not allow you to edit properties. Similarly, the designer will only connect to the master node.

When changes are made on the master, they are queued up to be sent to the backup node. When the backup connects, it retrieves these updates, or downloads a full system backup if it is too far out of date.

If the master node has modules that aren't present on the backup, they will be sent across. Both types of backup transfers- "data only" and "full"- will trigger the gateway to perform a soft reboot.

Runtime State Synchronization

Information that is only relevant to the running state, such as current alert states, is shared between nodes on a differential basis, so that the backup will take over with the same state that the master had. On first connection, or if the backup node falls too far out of sync, a full state transfer is performed. This information is light-weight and will not trigger a gateway restart.

Status Monitoring

Once connected, the nodes will begin monitoring each other for liveliness and configuration changes. While the master is up, the backup runs according to the **standby activity level** in the settings. When the master cannot be contacted by the backup for the specified amount of time, it is determined to be down, and the backup assumes responsibility. When the master becomes available again, responsibility will be dictated by the **recovery mode**, and the master will either take over immediately, or wait for user interaction.

System Activity

When a node is **active**, it runs fully, connecting to any configured OPC servers, and communicating with devices. When it is not active, its activity level is dictated by the settings, either **warm** or **cold**. In "warm" standby, the system will run as if it were active, with the exception of logging data or writing to devices, allowing for faster fail-over. In "cold" standby, the system does not subscribe to tag values, and does not communicate with any device. This allows the system to standby without putting additional load on the devices and network. Fail-over will take slightly longer, as tags must be subscribed and initialized.

Historical Logging

Historical data presents a unique challenge when working with redundancy, due to the fact that it is never possible for the backup node to know whether the master is truly down, or simply unreachable. If

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the master was running but unreachable due to a network failure, the backup node would become active, and would begin to log history at the same time as the master, who is still active. In some cases this is OK because the immediate availability of the data is more important than the fact that duplicate entries are logged, but in other cases, it's desirable to avoid duplicates, even at the cost of not having the data available until information about the master state is available. Ignition redundancy provides for both of these cases, with the **backup history level**, which can be either "Partial" or "Full". In "full" mode, the backup node logs data directly to the database. In "partial" mode, however, all historical data is cached until a connection is reestablished with the master. At that time, the backup and master communicate about the uptime of the master, and only the data that was collected while the master was truly down is forwarded to the database.

Client Fail-over

All Vision clients connect to the active node. When this system fails and is no longer available, they will automatically retarget to the other node. The reconnection and session establishment procedures are handled automatically, but the user will be notified that they have been transferred to a different node, so that they can notify the system administrator that they system may need attention.

4.12.3 Setting up Redundancy

To set up redundancy, you first must understand that both of the nodes share the exact same configuration state. This means that when a backup node joins to a master node, it will essentially download a backup of the master's state and restore that backup on itself. This fact leads to a couple of observations:

1. It is best to start with a fresh install for the backup node. The current configuration of the backup node will be overwritten, so make sure that it does not contain anything valuable in it when enabling redundancy.
2. All system configuration relative to the master node must also resolve on the backup node. For example, OPC-UA connections and database connections must use addresses that resolve from both nodes, any OPC-COM servers must be installed and configured identically on both nodes, etc.

With that in mind, setting up redundancy is fairly simple. Follow these steps to set up your redundant pair:

1. **Turn off firewalls between the redundancy nodes.** Redundant systems need TCP connectivity between each other on a variety of ports. Turning off software firewalls or adding special exception rules for each others' addresses is required. Specifically, The master node must be able to receive data on TCP/IP port **8750** (changeable in settings), and the backup node must be able to send outgoing data on that port.
2. **Configure the master node.**
   2.1. Set mode to 'Master' under the **Configuration > Redundancy** in the gateway configuration.
   2.2. It is advisable to turn off 'Auto-detect network interface' and to manually specify the address of the NIC (network interface card) to use for communication.
   2.3. The addition settings are described in the next section, redundancy settings.
3. **Configure the backup node**
   3.1. On the desired backup system, set the mode to 'Backup'.
   3.2. Under 'Backup Node Settings', specify the address of the master node. Also verify that the port is correct under 'Network Settings'.
   3.3. After saving, the system will connect to the master and will download a system backup, which will trigger a restart. After the restart is complete, the backup node should now be synchronized and in communication with the master.
4. **Verify Redundancy Setup with the System Map.** When you go to the status section of the

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gateway, the system map should show both connected nodes and should show their current states.

4.12.4 Redundancy Settings

All redundancy settings are configured in the Ignition configuration gateway under **Configuration>Redundancy**. Most settings are used by both the master and backup nodes, with their individual settings broken out into separate categories.

It is important to know that while the full system configuration is shared between nodes, **redundancy settings are not shared between nodes.** Therefore, it is perfectly acceptable to have different values for the same settings on the two nodes. For example, it is possible to have a different Standby Activity Level on both nodes, and, of course, the network settings will often be different.

Redundancy Settings

Mode

Independent - Redundancy is not enabled and this Ignition system runs as an independent node.

Master - This is the master node, who listens for a connection from the backup node, and is in charge of managing system synchronization.

Backup - This is the backup node, who will connect to the master and receive system updates.

Standby Activity Level

How the node operates when it is not the "active" node.

Cold - perform minimal activities, do not connect to devices, etc. Purpose: minimize the load on the network and on devices.

Warm - Connect to devices, subscribe to tags and set up all executing objects. Purpose: minimize fail-over time.

Fail-over Timeout

The time, in milliseconds, before the opposite node is determined to be unavailable and this node takes over.

Startup Connection Allowance

The time, in milliseconds, to wait on initial startup for a connection to be established before making a decision on the node's activity level. This is used to prevent unnecessary switch over caused by a node starting as active, only to connect and find that the other node is active, resulting in one of the nodes being de-activated. It is important to note that this setting can interfere with the Master Recovery Mode- if the master is active, it will always request the backup to de-activate. If this setting is low, or 0, the master will always become active before connecting to the backup, and thus "manual recovery" will not be possible.

Network Settings

Port

For the master, the port to listen on. For the backup, the port to connect to on the master.

Auto-detect Network Interface

If `true`, the system will automatically select which network interface to use on the machine. If `false`, the system will bind itself to the interface of the specified address.

Network Bind Interface

The address to bind to if Auto-detect is `false`.

Auto-detect HTTP Address

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When clients are launched, they are provided with a list of addresses that they may connect to. If this option is `true`, the list will be generated automatically. If `false`, they will be provided with the list specified.

HTTP Addresses
The list of addresses to give to the clients if auto-detect is turned off. These are the addresses that the clients will attempt to connect to, so the HTTP and HTTPS ports must match the configuration of the system in the Gateway Control Utility.

Master Node Settings

Recovery Mode
How the master acts when it connects to a backup node that is currently active.

Automatic - The master automatically takes back responsibility, and becomes active. The backup node goes to standby.

Manual - The backup node is allowed to stay active. The master will become active if the backup node fails, or if the user requests a switchover from the gateway configuration page.

Runtime Update Buffer Size
How many "runtime status updates" can be queued up in memory before the system stops tracking them and forces a full refresh. These updates represent information that the other node should have in order to have the same running state as the master when it's forced to take over. This is most often the values of static tags and the current alert state. Given that the update buffer is only used once the nodes are connected, the default value is usually fine, and only needs to be increased on systems that may have many alerts that change together, or many static tag writes.

Backup Node Settings

Master Node Address
The address where the master is located.

History Mode
How the backup node treats history when it is active.

Full - The system operates normally, and data is stored to the database.

Partial - The system caches all historical data until it can verify the time period that the master was actually down. This prevents the storage of duplicate data in the case that only the communication between the master and backup went down, resulting in a situation where both nodes ran as active for a period of time.

4.12.5 Database Considerations

Given that many parts of the Ignition system interact with the database, it's important to give some thought as to how it will be used when redundancy is turned on, and the different database architectures that are possible.

Ignition Database Requirements

When evaluating database architectures for use with Ignition, it's important to look carefully at how the system will use the database. Which pieces are critical? Which pieces are "optional", in that the system will continue to function while the database is down? Which pieces can operate in "read-only" mode if necessary?

Ignition uses the database for many purposes. Here are some common areas where they are used, and how availability can impact the system:

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SQLTags
If using the default internal provider, SQLTags only rely on the database for tags which execute queries. These tags will error out if the database is unavailable, but the status and control functionality of the system will function on the whole. If using an *external provider,* which is housed in the database, the tags will no longer function. Therefore it's much more important to have a read-capable database connection available when using external tags.

History - SQLTags and Other
All history in Ignition goes through the store-and-forward system, meaning that it will be cached until the database is available. However, while the data is cached, it will be unavailable to view or analyze on the clients. Therefore, when looking at how the database should be set up, it is necessary to determine how crucial rapid-availability of the data is.

Alerting
The alert status system does not reside in the database, so it will continue to function if the connection is down. Alert log information will go through the store and forward system as history data.

Project screens
Almost all projects use database access for providing information on screens. These queries will error out as long as the database is unavailable. Screens that only use SQLTags (in an internal provider) will continue to function, so it would be beneficial to make a distinction between status screens and history screens, if a failover database is not used.

Database Architectures

Single Shared Server
A single database server is used. The Ignition gateways will both use it, so it is expected to be available even when one of the nodes is not. For that reason, it almost always resides externally, on a separate server machine.

This arrangement is the easiest to use with Ignition. A single database connection configured on the master will be replicated to the backup, and both nodes will use the connection as necessary.

Clustered/Replicated Database Servers
There is a wide variety of capabilities supported by the different brands of database servers. To obtain fault-tolerance on the database front, it is usually necessary to have some sort of cluster/replication system in place. However, it can be very import to examine how Ignition is using the databases, and what capabilities the clustering solution provides.

For example, in many replication scenarios, the master database copies data to the backup. The backup can be used for read purposes, but new data inserted will not be replicated back to the master. Therefore, it is possible to have a failover connection to the backup database, so that clients will continue to receive data, but it would be necessary to run in *partial history mode*, so that the historical data was cached and inserted only to the master database. The failover connection would be set to *standard* mode, so the primary connection would be used when possible.

In a more complete cluster environment, where writes to either node would be replicated, a *sticky* failover connection could be used with *full history mode.*

Pertinent Settings

When working with various database architectures, there are a few settings in various parts of the system that are important.

Database connection settings - Failover Datasource
Any database connection can have a failover datasource. If the main connection is unavailable, any

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queries executed on it will pass through to the secondary connection. In this way, a secondary database can be used when the first is not available, and the system will continue to function. It is important to note that everything passed through to the failover will function normally- no special considerations will be made. For example, the system won't cache data for the primary connection, it will forward it to the secondary. In cases where you want to allow reading from the secondary database, but not writing, you can set up another connection directly to the first database, with no failover, and set all of your write operations to use that.

Clustering settings - History Mode

The history mode dictates how history will be treated when the node is not active. If *partial*, the data will be cached, and only forwarded when the master node is available. This mode can be used to prevent data from being inserted into a backup database in some cases.

4.12.6 Troubleshooting Redundancy

Troubleshooting Connectivity

When the two redundant nodes are connected, the will both appear along with their state details in the Status section of the gateway. There are also various other places where the redundancy state is shown as "connected". If the two nodes cannot connect, check the following:

Verify that the master address is correct in the backup. Try to ping the master machine from the backup machine, and verify that you're using the correct address for the network card that the master is connected through.
If using system names (or domain names), verify that the name is resolving to the correct address by performing a ping.
Verify that the firewall on the master is set to allow TCP traffic to the designated port.
Verify that the backup is not connecting and then immediately disconnected for some reason. Viewing the error log in the gateway console section should show this. If errors are occurring at regular intervals, look at the message for an indication of what is happening. An example of a potential problem is when the failover time is set too low for the given network, which results in many socket read timeout exceptions, which in turn leads to many disconnect/reconnect attempts. If errors are occurring, but the cause isn't clear, contact Inductive Automation support.

Advanced Troubleshooting

A variety of loggers can be found under the gateway console section by going to "Levels" and searching for "Redundancy". By setting these loggers to a finer level, more information will be logged to the console. This is generally only useful under the guidance of Inductive Automation support personnel, though more advanced users may find the additional logged information helpful.

4.13 Mobile Module

4.13.1 Mobile Module Settings

There is very little setup involved with the mobile module. Usually the default settings should suffice with the exception of the Server Address setting.

Settings

Java Path

This is the path to the Java executable on the Ignition Gateway server machine. The Java 6 JRE is required for the mobile module; it is NOT compatible with Java 7. A default value of “java” assumes that

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Java 6 is on the path and can be invoked merely with the “java” keyword.

Client Memory
The amount of space allowed for each mobile client that is launched. Mobile clients are virtual clients that are launched on the server. All of the work is done on the server and transmitted to the mobile device so keep in mind that more mobile clients means more memory and CPU consumption on the server.

JVM Options
Command-line JVM options to use when launching mobile client VM's. Multiple options are separated with spaces. This option is made available mostly for troubleshooting by technical support staff, but if you are familiar with java and comfortable with command-line arguments then you can specify ones you may find useful here.

Environment Variables
Here you can specify any environment variables in the format of NAME=VALUE.

Idle VMs
The number of client VMs to startup and wait for incoming mobile connections. These will start when the gateway is started and sit idle until a mobile connection is made. This should be left at the default value of 0 unless it is taking a long time to launch a mobile client. It's important to note that the VMs that are sitting idle are not connected to a project so it will still take time to load the selected project.

Server Address
This is the address to use when launching from the QR code on the launch page. This is a setting that often causes confusion. Initially this value is blank by default which results in the QR code pointing to the address of http://localhost:8088. Since Ignition is not running on your mobile device this address will not actually launch the mobile homepage. This should be set to the Ignition server address that can be reached by the mobile device.

Networking

Callback Port
The port that the VMs use to communicate to the Gateway on. By default this is set to 45900, but if this port is already in use then change this to an available port.

Callback Interface
The interface that mobile client VMs should use to communicate back to the Gateway on. By default this is localhost and makes use of the loopback adapter, however if this host doesn't have a loopback adapter or if there are two network cards, set this to the IP address of the NIC that should be used for local loopback.

Ajax Timeout
The max time, in milliseconds, that each request has to complete. The default is 10,000 (10sec).

Advanced Properties

The Mobile Module also has an option to allow VNC connections. This allows certain thin clients that do not support the Java Runtime Environment and also do not have an HTML 5 compatible browser to launch Ignition clients. The settings listed under the advanced properties section all have to do with configuring the VNC connection.

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Enable VNC
Allows direct thin-client connection over VNC.

VNC Port
The port used for the VNC connection

Project Name
The Mobile Module only allows one of the projects on the Ignition gateway to be viewed through VNC so you have to specify that project here. Unlike the normal mobile launch screen that allows you to choose a project, the project that you specify in this setting will be automatically launched when you connect via a VNC viewer application.

Project Width
The width of the project when it's launched

Project Height
The height of the project when it is launched

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Project Design

Part V

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5 Project Design

5.1 Designer Introduction

The Ignition Designer is where the majority of configuration and design work is done in Ignition. It is used to configure *Projects*, which are the major unit of design. Projects contain various *resources*, such as *windows* and *transaction groups*. A project may contain a variety of different types of resources, depending on the goal of the project and the modules installed.

Common First Steps
Create some SQLTags
Create a Window
Create a Transaction Group

See also:
Launching the Designer
What is a Project?

5.2 Using the Designer

5.2.1 Logging into the Designer

Click on the "Launch Designer" button near the top-right corner of any Gateway page to launch the Ignition Designer. To log into the Designer, you need to use a username and password that:
1. Is valid for the *System user source*. This is set in the Gateway Settings section of the Gateway's web configuration interface.
2. Has at least one of the roles defined in the *Designer Role(s)* field in the Gateway Settings page.

5.2.2 Creating or Opening a Project

After logging into the Designer, or at anytime through the Designer's `File > Open` menu, you will be prompted to either open an existing project or create a new project. A project must have a name and an user source. You may also specify a default database connection and a default SQLTags provider for your project.

See also:
Project General Properties

5.2.3 Designer UI Overview

The Designer is organized around a central *workspace*. The workspace changes based on the type of *resource* that you are currently editing. For example, if you are editing a Window, then your workspace will be the Window Designer. If you are editing a Transaction Group, your workspace will be the Transaction Group Editor, etc.

There are many *dockable panels* that surround the workspace, as well as the familiar menu bars and toolbars. The dockable panels may be rearranged to your liking. Each type of workspace may have panels that are only valid when that workspace is active. Each workspace remembers its own *perspective*, which is the docking arrangement of the panels around it. If you have closed a panel and want to get it back, re-enable it in the `View > Panels` submenu.

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5.2.4 Using the Docking System

The Designer's docking system allows for a very flexible user interface, allowing a user to customize the layout to their liking. To re-arrange the dockable panels, simply drag on their title bars. As you are dragging the panel, use the highlighted border that appears to gauge where the panel will be moved to. Dockable panels can be in one of four modes:

1. Docked. The panel is visible, and located somewhere around the perimeter of the workspace. If two panels are docked in the same location, a tab strip will appear to switch between the two panels.
2. Floating. A panel can be dragged outside of the workspace perimeter to be floated. The panel can now be positioned anywhere on your desktop.
3. Pinned. Pinning a panel makes it minimize to one of the four sides of the Designer, represented by a small tab. Hover over the tab to use the panel.
4. Hidden. A hidden panel is not shown. You can open it again by selecting it in the View > Panels menu.

Toolbars can also be rearranged and floated to your liking. Simply drag on the "textured" left edge of the toolbar.

If you have re-arranged your panels into a layout that you don't like, you can quickly revert back to the default by selecting the View > Reset Panels option from the menu bar.

☞ *Expert tip:* Your docking preferences are stored under `%USER_HOME%/.ignition/*.layout`. If you really want to reset your preferences, remove these files and restart the Designer.

5.2.5 Communication Modes

The Designer has three communication modes that affect data flow to and from the Gateway:

Off: All database query traffic and tag subscriptions and writes will be blocked.
Read-Only: tag subscriptions and SELECT queries will work, but tag writes and UPDATE/INSERT/DELETE queries will be blocked.
Read/Write: All data will be passed through to the Gateway.

The mode can be switched at any time via the tri-state toggle selection in the main toolbar, or the radio buttons in the Project menu. The Designer starts up in **Read-Only** mode as a safety mechanism, so that you don't inadvertently write to a tag as you are designing. You can customize the designer's startup mode, see the Designer General Properties section.

A common beginner mistake is to forget to switch the mode to **Read/Write** when attempting to test a window's functionality in preview mode.

A component with the GW_COMM_OFF quality overlay

Experts often use the **Off** mode while designing a window to temporarily shut off data flow so that they can manipulate components' bound properties without the values being overwritten by the data bindings. This is useful to set the values that they want to serialize into the window. This can be important for windows with large datasets; clearing the datasets before saving the window can significantly reduce the size of the window, improving performance.

Note: This setting does not affect the execution of a project's *transaction groups*. This is because

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transaction groups execute on the Gateway, not in the Designer.

5.2.6 Designer Tools

5.2.6.1 Output Console

The *Output Console* is the script-writers best friend. It is a dockable panel, and can be opened via the `Tools > Console` menu or the `Ctrl-Shift-C` keyboard shortcut.

The output console is most frequently used to test and debug Python scripts in Ignition. By using the `print` keyword in your script, you can observe the inner workings of your script as it executes. For example, if you executed the following script:

```
# A function that intercepts tag writes, printing out the previous value first
def writeToTag(path, value):
   import system
   prevValue = system.tag.getTagValue(path)
   print "Writing value '%s' to %s, was previously '%s'" % (value, path, prevValue)
   system.tag.writeToTag(path, value)

writeToTag("Compressor/HOA", 2)
writeToTag("Compressor/HOA", 1)
```

It would print the following to the console:

```
Writing value '2' to Compressor/HOA, was previously '0'
Writing value '1' to Compressor/HOA, was previously '2'
```

Note that the output console is also available in the Vision Client, via the Diagnostics window.

See also:
About Python
Diagnostics Window

5.2.6.2 Diagnostics Window

The Diagnostics window, which is available in both the Designer and the Vision Client, contains a number of useful troubleshooting features. It features a number of tabs, some of which are initially hidden. Right-click on any of the visible tabs to show or hide other tabs.

Performance
Displays a number of small realtime charts that display various aspects of the currently executing Designer or Client's performance. These charts can be very useful to help troubleshoot performance issues, especially slow queries. One of the most common causes of query slowdown is simply running too many queries too frequently, and the *# of Select Queries / Second* chart can help identify when this is occurring.

Console
Displays the Output Console.

Log Viewer
Displays the logged events for the current Designer or Client session. Whenever errors occur, they will be logged and displayed in this tab. This is a good place to go when troubleshooting an issue, as any errors shown here may illuminate the cause of the problem. To view entries across all categories chronologically, uncheck the *Group Categories* checkbox.

Logging Levels

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Determines the verbosity of a host of internal loggers. Most users will not use this tab unless prompted by a technical support representative.

Thread Viewer
Shows information about the currently running threads. Most users will not use this tab unless prompted by a technical support representative.

5.2.6.3 Find / Replace

The Find / Replace tool is a very handy tool. It can be used to search an entire project for where a tag gets used. The replace feature can also be used to to make mass changes to a project with very little effort. To open the Find/Replace dialog box, choose the menu item under the Edit menu or use the shortcut Ctrl-F.

Finding

To search through your project, simply type what you're searching for in the text field at the top and press the Find button. You can use the wildcard character (*) which will match anything, and the single-character wildcard character (?).

For example, to find all references to a tag that include the string "`Motor`", you'd search for "`Motor*`". This would match things like "`Motor15`", "`MotorHOA`", etc, whereas the search query "`Valve?Status`" would match "`Valve1Status`" but not "`Valve38Status`"

Target Scope

To narrow down your search, it is often useful to specify a narrow search target. The Find / Replace system searches through many different parts of a project, and through SQLTags as well. The target settings let you specify exactly what to search through. By unchecking boxes in the target section, you can avoid search results that you aren't interested in.

Results

When you execute a search, all matching items appear in the search results section. You can double-click on an item in the results table to bring that item into editing focus in the Designer.

Replace

To use the replace feature, select a result entry after doing a search. You'll see the current value with the matching area in bold-face font. Enter the text you'd like to use as a replacement in the Replace text-box, and you'll be shown a preview of the new value in the preview box. Hit the Replace button to execute the replace. This will move your selection down in the results table so that you can rapidly execute multiple replacements. If you're satisfied that you'd like to make the identical replacement to many items, select them all in the results table in hit the Replace All button.

5.2.6.4 Image Manager

The Image Manager is available from the `Tools > Image Management` menu. This tool is a drag-and-drop browser that helps manage the images that are stored on the Gateway. It is important to realize that these images are shared across all projects: they are not stored inside a project itself.

Use the toolbar at the top to do common tasks like uploading new images and creating folders. You can drag images from your computer's desktop or hard drive into this window to easily upload new images to

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the Gateway.

You can also get to this tool by putting an *Image* component on a window, and using the browse button on the image's *Image Path* property.

See also:
Image Component

5.2.6.5 Symbol Factory

If you have the Symbol Factory module installed, you'll be able to open the symbol browser under the `Tools` menu in the Designer. You can browse through the symbols or use the convenient search function to find the symbol you need. Once you find a symbol, you can drag-and-drop it into a window.

Each symbol will be dropped as a shape group. You will be able to un-group it or double-click into the group just as if you had drawn the symbol yourself using fundamental shapes. This means that you can alter the shape if you need to, or bind any colors inside the shape to a tag to make the shape dynamic.

5.2.6.6 Query Browser

The Query Browser is a very convenient tool that lets you interact with all of the databases that you have configured connections for. Because Ignition is so heavily integrated with databases, it is very common in the course of project design to need to inspect the database directly, or to experiment with a SQL query to get it just right.

You can use the auto-refresh option in the Query Browser to monitor a database table for changes. This is often convenient when designing Transaction Groups. As the group runs, you can view the table that it is targeting with auto-refresh turned on to watch how the group is altering the table.

The Query Browser is a convenient way to make simple edits in a database table as well. If you execute a SELECT query that includes the table's *primary key(s)*, then you may activate e*dit mode* by selecting the *Edit* button. While in edit mode, you can alter the values in the result set. Make sure to hit *Apply* when you are done to commit your edits, or press *Discard* to back out. Note that this feature depends on the applicable JDBC driver's ability to detect the table's primary keys.

See also:
Creating a Database Connection

5.3 SQLTags

5.3.1 What is a SQLTag?

A SQLTag, in many ways, is what is simply considered a "tag" in other systems. They are points of data, and may have static values or dynamic values that come from an OPC address, an expression, or a SQL query. They also offer scaling, alarming, and meta information facilities.

SQLTags provide a consistent data model throughout Ignition, and offer the easiest way to get up and running creating status, control, and simple history systems. Despite their low initial learning curve, however, SQLTags offer a great amount of power in system design and configuration. The ability to aggregate tags from a variety of installations in a central SQL database means that you can build widely distributed SCADA systems more easily than ever before, with a high level of performance and relatively easy configuration. SQLTag User Defined Types (UDTs) provide an object-oriented approach to tag building, allowing you to define parameterized data types, extend and override types, and then rapidly generate instances. A change to the type definition is then inherited by all instances, drastically saving

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time when making routine changes. The UDT data types are fully supported by Vision templates, which means you can configure templates for your custom data types and take advantage of drag-and-drop binding to rapidly build complex screens.

For more information about the benefits of SQLTags, see the SQLTags Overview in the Architecture chapter.

Tag Execution

SQLTags are executed by *scan classes* inside of a *tag provider*. In a typical system there will be one or two tag providers (the internal provider, which keeps the tag configuration in the project, and possibly an external tag provider in which tag configuration and values are stored in a database), and a number of scan classes.

SQLTags stored in an external provider will be available to all Ignition installations that have access to that database. One of the installations will be specified as the tag's *driver*. The driving system will have a copy of the scan class that it executes, which in turn evaluates the tag. The value will be stored to the database, and all of the other installations will be notified of the new value.

For more information about providers, see SQLTags in the gateway configuration section.

What can tags do?

Fundamentally, the primary goal of a tag is to represent a value in the Ignition system. The values can come from OPC, expressions, queries, etc., and can be used on screens, in transaction groups, and more. Additionally, SQLTags provide a core set of features above and beyond simple values:

- Alarming
- Scaling
- Meta information
- History

Depending on the specific type of tag, even more options may be available. In general, SQLTags provide a common interface for tying together many types of data in Ignition.

5.3.2 Types of SQLTags

There are several types of SQLTags. While in discussing "SQLTags" we commonly mean gateway executed tags, system and client tags can play an important role in the overall design of a project.

Gateway Executed Tags

Tags executed in the gateway support all of the primary features of SQLTags: scaling, alerting, history, and role based permissions. They are identical in their configurations, apart from defining how the value is generated.

OPC Tags
: OPC tags specify an OPC server and address which drives their values. The OPC address will be subscribed at the rate of the tag's scan class.

Memory Tags
: These tags are simply values. The value is specified during configuration, and is stored when written (if the tag allows writing).

Expression Tags
: These tags are driven by an expression. The expression syntax is the same as for property bindings,

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and allows mathematical operations, references to other tags, logic operations and more.

SQL Query Tags
These tags execute a SQL Query, whose result provides the value for the tag. Like SQL binding in Vision, SQL Query tags can reference other tags to build dynamic queries.

Complex Tags (UDTs)
Complex tags are created out of standard tag types, but offer a variety of additional features. In simple terms, you can think of them as a way to create "data templates", where a particular structure of tags is defined, and can then be created as if it were a single tag.

System Tags

System tags provide status about the system, such as memory usage, performance metrics, etc. They exist for the client and the gateway. Gateway system tags can be modified by the user to use alerting, history, and scaling, while client tags cannot.

Client Tags

Client tags, as the name implies, are only available for use in clients. This means that their values are isolated to a client runtime, and even though they are created in the designer, each client will create their own instances. This makes them very useful as in-project variables, for passing information between screens, and between other parts of the clients, such as scripting.

Client tags are a hybrid of memory, expression, and sql query tags. However, they do not have a scan class. When set to run as an expression or query, a poll rate is specified dictating how often the value should be calculated.

5.3.3 Creating SQLTags

Creating From OPC Tags

The easiest and most common way to create SQLTags is to drag tags into the *SQLTags Browser* window from the OPC Browser . After browsing OPC and finding the tags that you want, simply drag and drop them onto the correct tag provider, and the system will create OPC SQLTags for each.

Creating Tags Manually

The above method only works for OPC tags, and then only for browsable tags. For other types of tags, as well as OPC tags that cannot be obtained through browsing, you can click on the "new tag" button or right-click on the provider node and select "New Tag".

Converting Tag Types

Once created, it is possible to convert a tag to a different type- such as from OPC to Expression. To do this, right click on the tag, and select "Convert Tag"

Re-naming SQLTags

Tags can be named anything (inside the rules of allowed characters). In other words, it is not necessary that tag's name be related at all to its underlying data source (opc path, for instance). This provides a level of indirection that is convenient for systems whose underlying data storage changes, or for system with many repeat tag structures. By providing tags with meaningful names and arranging them in

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hierarchical folders, *indirect binding* can be used to create robust screens that can be used for multiple systems.

Valid characters for *SQLTag* names include **spaces** and the following:
1234567890_-abcdefghijklmnopqrstuwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ

5.3.4 Basic Tag Properties

5.3.4.1 General Properties

Properties common to most tags

Property	Binding Name	Description
Name	`Name`	How the tag will be presented and referenced in the system. The tag path will be the provider, the folder structure, and this name.
Value	`Value`	The value of the tag. Can only be modified if the tag allows value writing and the user has sufficient privileges.
Quality	`Quality`	The data quality of the value. If not *GOOD (*integer value 192), the value should not be trusted. The Data Quality section explains quality codes in more depth.
Datatype	`Datatype`	The type of the value. It is important that this be set as correctly as possible with regards to the tag's underlying data source. The SQLTags system will attempt to coerce any raw incoming value (for example, from OPC or a SQL query) into the desired type.
Enabled	`Enabled`	Whether the tag will be evaluated by the scan class. If false, the tag will still be present, but will have a bad quality.
Access Mode	`AccessRights`	Specifies the access level allowed to the tag- read/write, read only, or custom. If custom, the tag will use the permission settings
Scan Class	`ScanClass`	The scan class that will execute the tag. The scan class dictates the rate and conditions on which the tag will be evaluated.

Additional properties - OPC Tags

Property	Binding Name	Description
OPC Server	`OPCServer`	The server against which to subscribe the data point.
OPC Item Path	`OPCItemPath`	The path to subscribe to on the server. The point will be subscribed at the rate dictated by the scan class.

Additional properties - Tag in external providers

Property	Binding Name	Description
Driver	`DriverName`	The name of the Ignition gateway that will be responsible for the execution of the tag. All other gateways will monitor the value.

5.3.4.2 Numeric Properties

The numerical properties are available to OPC, DB, and Client tags whose data types are numeric.

Property	Binding Name	Description
Scale mode	`ScaleMode`	If and how the tag value will be scaled between the source, and what is reported for the tag.
Deadband	`Deadband`	A floating point value used to prevent unnecessary updates for tags whose

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values "float" by small amounts.

Scaling Settings

Property	Binding Name	Description
Raw Lo	`RawLow`	Start of the "raw" value range
Raw Hi	`RawHigh`	End of the "raw" value range
Scaled Lo	`ScaledLow`	Start of "scaled" value range. Raw low will map to Scaled low for the tag.
Scaled Hi	`ScaledHigh`	End of "scaled" value range. Raw high will map to Scaled high for the tag.
Clamp Mode	`ClampMode`	How values that fall outside of the ranges will be treated. "Clamped" values will be adjusted to the low/high scaled value as appropriate.
Scale Factor	`ScaleFactor`	For single parameter modes (currently only Exponential Filter), the factor parameter for the equation.

Linear Scaling

The value will be scaled linearly between the low and high values, and clamped as appropriate.

The linear equation is:

$$ScaledValue = \Delta S * (Value-R_L)/\Delta R + S_L$$

Square root Scaling

The equation for square root scaling is:

$$ScaledValue = (\Delta S * (Value-R_L)/\Delta R) + S_L$$

... where ΔS is (ScaledHigh-ScaledLow), ΔR is (RawHigh - RawLow), R_L is RawLow, and S_L is ScaledLow

Exponential Filter

This mode implements a simple linear recursive filter to smooth values. The scale factor corresponds to the weight of the smoothing effect, and is a value between 0.0 and 1.0. The smaller the factor, the greater the degree of smoothing.

The equation for the filter is:

```
y(t) = (1-f)*y(t-1)+f*x(t)
```

With:

y(t) = the output at time t.

y(t-1) = the previous output

x(t) = the input value (current value)

f = the scale factor, with 0.0<=f<=1.0

Note: Only "good" quality values are considered for the filter. Bad quality values will be ignored.

5.3.4.3 Metadata Properties

The metadata properties provide informational properties for a tag. The values of these fields can be read and modified through scripting, or bound to properties such as range, tooltips, etc.

Property	Binding Name	Description
Format	`FormatString`	How the value should be formatted when converted to a string (only applies to numerical data types)
Eng. Units	`EngUnit`	The engineering units of the value

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Eng. Low	`EngLow`	The lowest expected value of the tag.
Eng. High	`EngHigh`	The highest expected value of the tag
Eng. Limit Enforcement	`EngLimitMode`	Dictates how the engineering range should be enforced on the tag. If not "none", the tag will change to bad quality ("limit exceeded"), when the value exceeds the specified range.
Tooltip	`Tooltip`	The tooltip provides a hint to visual components as to what should be displayed when the user hovers their mouse cursor over the component that is being driven by the value of this tag.
Documentation	`Documentation`	A freeform text property for information about the tag

5.3.4.4 Permission Properties

By default, a tag's Access Mode property is set to **Read/Write**, which means that any user may read the value of the tag and may write to the tag. **Read-only** mode makes the tag non-writeable for all users.

Custom mode allows the tag to assign read/write or read-only privileges to *individual roles*. Any roles not explicitly granted a right by using the custom permissions editor will not be able to read the tag's value or write to the tag.

5.3.4.5 History Properties

The properties on the *History* tab detail if and how the tag's history will be stored in the SQLTags Historian system.

Property	Binding Name	Description
Store History	`HistoryEnabled`	Whether the tag will report its history to the SQLTags Historian system.
History Provider	`PrimaryHistoryProvider`	Which SQLTags Historian data store the tag will target. A particular tag can only target one history store.
Historical Scan Class	`HistoricalScanclass`	The scan class to use to evaluate tag history. This allows the tag's history to be stored at a slower rate than the status is updated at.
Historical Deadband	`HistoricalDeadband`	A deadband that applies only to historical evaluation.
Value Mode	`InterpolationMode`	How interpolation will be handled for the tag in querying. See below for more information.
Max Time Between Records	`HistoryMaxAgeMode / HistoryMaxAge`	The maximum amount of time that can pass before a new record is logged for the tag.
Timestamp Source	`HistoryTimestampSource`	Which timestamp is used for the value of the tag.

Value Mode

The value mode, *analog* or *discrete*, dictates the type of value that the tag represents, and will affect how the deadband is applied to values, and how interpolation should be performed when querying. *Interpolation* is the method in which the SQLTags Historian query system generates values for a tag when the desired time does not fall directly on a sample timestamp.

Discrete

Storage - The deadband will be applied directly to the value. That is, a new value (V_1) will only be stored when: $|V_1-V_0|$ >= Deadband.

Interpolation - The value will not be interpolated. The value returned will be the previous known value, up until the point at which the next value was recorded.

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Analog

Storage - The deadband is used to form a corridor along the trajectory of the value. A new value is only stored when it falls outside the previous corridor. When this occurs, the trajectory is recalculated, and a new corridor formed. See below for an example.

Interpolation - The value will be interpolated linearly between the last value and the next value. For example, if the value at $Time_0$ was 1, and the value at $Time_2$ is 3, selecting $Time_1$ will return 2.

Max Time Between Records

Normally SQLTags Historian only stores records when values change. By default, an "unlimited" amount of time can pass between records- if the value doesn't change, a new row is never inserted in the database. By modifying this setting, it is possible to specify the maximum number of scan class execution cycles that can occur before a value is recorded. Setting the value to 1, for example, would cause the tag value to be inserted *each execution*, even if it has not changed. Given the amount of extra data in the database that this would lead to, it's important to only change this property when necessary.

Timestamp Source

When a SQLTag executes, there are two possible timestamps that can be observed: the time associated with the data, and the time that the tag was evaluated. The first case is generally only interesting when the value is provided by an OPC server. In most cases, the time provided by OPC, which in Ignition is referred to as the "Value" time, will be very close to the system time. Some servers, however, either due to their location or how they function (history playback, for example), will provide times that are very different than the current time.

It is generally desirable to store the System time, as it is the time that the value was actually observed by the system, and it creates a uniform timeframe for all realtime data. However, in the later case described above, it is necessary to store the time provided by the OPC server. Using the Value timestamp source has several consequences: the system is no longer able to validate the tag quality against the scan class' execution, and tag value interpolation will behave differently.

The validation of the scan class execution is generally not a concern when recording historical playback data. Interpolation only occurs when the value mode is Analog, and when there is not a value for every time window. Using System time, the value is only interpolated during the last "scan class execution window", that is, one scan class timeframe before the next value. Using Value time, however, the value is interpolated for the entire time between two data points.

The Deadband, and Analog Compression

As described above, the deadband value is used differently depending on whether the tag is configured as a Discrete tag, or an Analog tag. Its use with discrete values is straight forward, registered a change any time the value moves +/- the specified amount from the last stored value. With Analog tags, however, the deadband value is used more as a compression threshold, in an algorithm similar to that employed in other Historian packages. Its behavior may not be immediately clear, so the following images show the process in action, comparing a raw value trend to a "compressed" trend.

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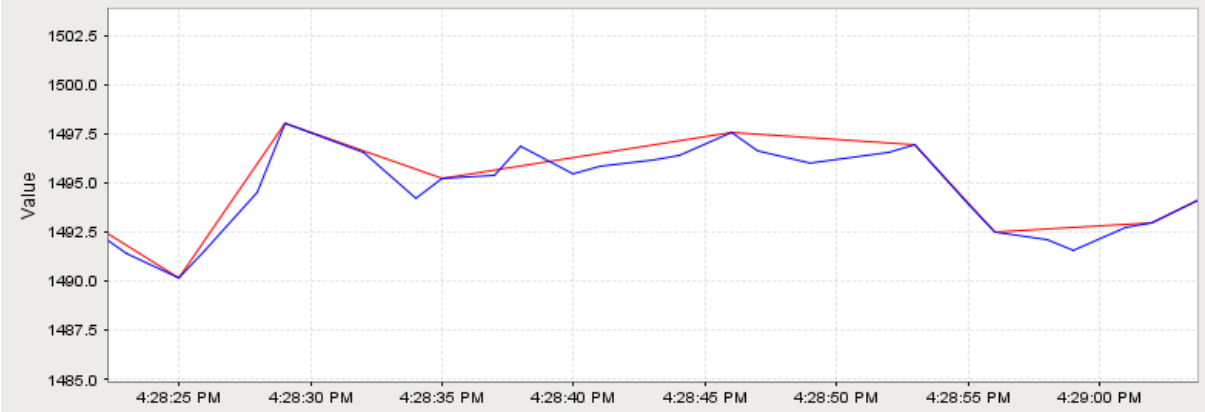
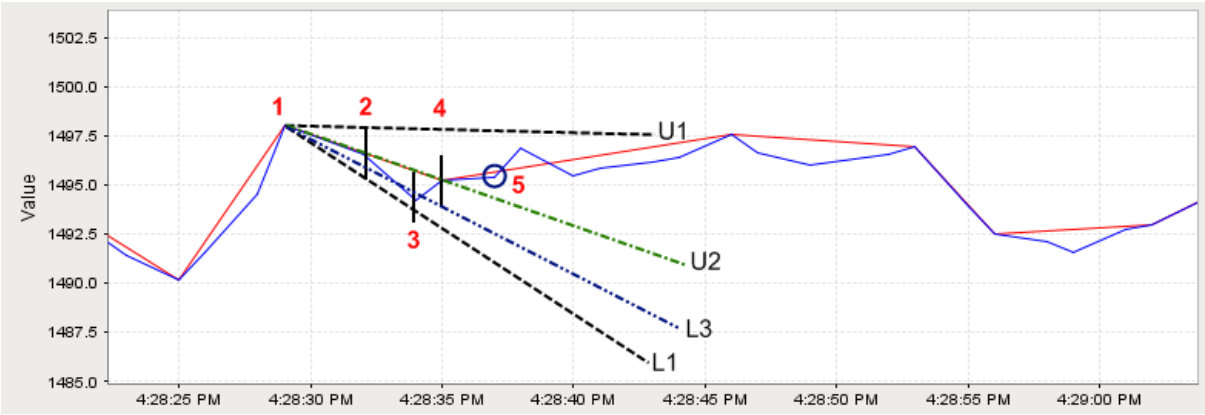


Raw (blue) vs. Compressed (red) Data

In this image, an analog value has been stored. The graph has been zoomed in to show detail; the value changes often and ranges over time +/- 10 points from around 1490.0. The compressed value was stored using a deadband value of 1.0, which is only about .06% of the raw value, or about 5% of the effective range. The raw value was stored using the Analog tag mode, but with a deadband of 0.0. While not exactly pertinent to the explanation of the algorithm, it is worth noting that the data size of the compressed value, in this instance, was 54% less than that of the raw value.

By looking at one specific sequence, we can see how the algorithm works:



The sequence starts with the second stored compressed value on the chart.

1. A value is stored. No further action is taken.
2. The next value arrives. A line is made through the value, with the size of the specified deadband value. A line is projected from the last stored value to the upper (line U1), and lower (line L1), bounds of this new value line. This establishes the initial corridor.
3. A new value arrives. The same procedure is taken, and new lines are created. However, only lines that are more restrictive than the previous are used. In this case, that means only line U2, the new upper line.
4. Another value arrives, causing a new lower line (L3) to be used.
5. Finally, a value arrives that falls outside of our corridor. The last received value (value 4) is stored, and a the process is started again from that point.

5.3.4.6 Alarming Properties

Tags have the ability to define any number of *alarms*. Each alarm is a condition that will be evaluated when the value of the tag changes. When the condition becomes true, the alarm is said to be *active*.

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When it becomes false, the alarm is said to be *clear*.

Binding

Many alarm properties are *bindable*, which means they can be bound to other tags in the system, or expressions. For example, you might bind the *enabled* property to another tag which represents whether or not your process is running, thereby disabling the alarm when production is stopped. Or, you might bind the setpoint of an alarm to a tag that operators can manipulate, thereby letting the setpoint be changed at runtime.

To bind a tag, simply click on the binding icon ( ), and the binding UI will slide in from the right. From here you can select the binding type (No Binding, Tag, Expression, or UDT Parameter, if applicable). Note that the expression can reference many useful values such as the tag's value and other settings of the alarm. When you've configured the binding to your liking, click on the "Back" button.

Associated Data

Associated data are custom alarm properties that can be added to any alarm. These properties will often be bound to other tags that represent associated contextual data that may be related to the alarm. A snapshot of the values of these properties will be taken when the alarm becomes active. These values will be attached to the alarm event as it moves through the rest of the alarming system, meaning that the values will be available from the alarm status system, the alarm journal system, and in the alarm notification system.

Main Alarm Settings

Alarm Name
Each alarm has it's own name. For example, if the tag is representing a level, the alarm name might be "High Level".

Enabled
This boolean determines whether or not the alarm will be evaluated. A disabled alarm's condition will not be evaluated, and thus will not generate any alarm events.

Priority
An alarm's priority can affect how is appears in an alarm status table, or can affect how it is escalated through a pipeline. The priorities, which can be referenced by their integer equivalent in scripts and expressions, are: Diagnostic [0], Low [1], Medium [2], High [3], Critical [4]

Timestamp Source
Chooses where the timestamp for the alarm event should come from: the system time of when the event was generated, or the timestamp of the *value* that tripped the event.

Display Path
This is a string value that will be used to display the alarm to operators. If this is blank, the operator will see the path to the tag instead. Please use the forward-slash character to separate hierarchy levels in this path, for example: "`East Area/Boilers/Boiler5`"

Ack Mode
Dictates how acknowledgement works for the alarm.

Unused - Acknowledgement will not be used for this tag, and any alarm that is generated will automatically be marked as acknowledged.

Auto - The alarm is acknowledged automatically when the alarm becomes cleared.

Manual - The alert is never set to acknowledged by the system, and it is up to the user to

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manually acknowledge alerts.

Notes
A place for any free-form documentation about the alarm that can be displayed to operators.

Ack Notes Required
If this setting is true, the operators will be unable to acknowledge this alarm without entering some notes.

Shelving Allowed
If this setting is true, the shelving feature will be unavailable for this alarm.

Alarm Mode Settings

Mode
This setting controls what condition this alarm is evaluating. Available modes are:

Equal - Active when the tag's value equals the alarm's setpoint.

Not Equal - Active when the tag's value does not equal the alarm's setpoint.

Above Setpoint - Active when the tag's value is above the alarm's setpoint.

Below Setpoint - Active when the tag's value is below the alarm's setpoint.

Between Setpoints - Active when the tag's value is between the low and high setpoints. If any change is true, an event will be generated for each value change between the setpoints.

Outside Setpoints - Active when the tag's value falls outside the low and high setpoints. If any change is true, and event will be generated for each value change outside the setpoints.

Out of range - The same as Outside Setpoints, but uses the tag's Engineering High and Engineering Low as the high and low setpoints.

Bad Quality - Active if the tag value becomes a bad quality, for example, on comm loss.

Any Change - An alarm event is generated every time the tag value changes. Note that this alarm will never be "active" because each active event is paired with a matching clear event, instantly.

Bit State - This alarm mode is used to alarm when a specific bit out of an integer tag becomes high. You must specify which bit position to use, with zero being the least significant bit. The On Zero property is used to invert the logic and alarm when the bit is low.

On Condition - This free-form alarm mode is used for when you want to specify the condition using an expression or another tag. To do this, bind the "*Is Active*" property to an appropriate expression or tag.

Setpoint / Low Setpoint / High Setpoint
The setpoint properties are used for many alarm modes to specify in what range the alarm becomes active.

Inclusive / Low Inclusive / High Inclusive
These settings correspond to a setpoint. If true, the range will be active if the value is exactly equal to the setpoint, not only above or below it.

Deadbands and Time Delays

Deadband Mode
Absolute - The deadband setting is considered to be an absolute value.

Percent - The actual deadband is calculated as a percent of the tag's engineering unit span.

Deadband
The value for the deadband, interpreted according to the deadband mode. Note that all alarms are only evaluated after the tag's value changes, which means that the tag's own deadband will be considered first.

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When the deadband positive, an active alarm condition needs to clear it's setpoint(s) by the amount of the deadband for the alarm to clear. For example, suppose you had a Between Setpoints alarm with a low setpoint of 50 and a high setpoint of 70, with a deadband of 2. The alarm will go active if the value is between 50 and 70, but will only clear if the value falls below 48 or rises above 72.

Active Delay
The time, in seconds, before the *alarm* will be considered active after the alarm's *condition* becomes true. Also known as a "rising edge time deadband"

Clear Delay
The time, in seconds, before an active *alarm* will be considired clear after the alarm's *condition* becomes false. Also known as a "falling edge time deadband".

Notification Settings

Active Pipeline
The name of an alarm notification pipeline to put this alarm into when it becomes active in order to send out active alarm messages. Many alarms may share a single pipeline.

Clear Pipeline
The name of an alarm notification pipeline to put this alarm into when it becomes clear in order to send out clear messages.

Email Notification Settings

Custom Subject
A string that will be used as the subject line of an email notification message. If blank, the message settings defined on the notification block that sent the email out will be used instead.

Custom Message
A string that will be used as the body of this alarm's email notification message. If blank, the message settings defined on the notification block that sent the email out will be used instead.

Extended Configuration Settings

Various modules may add additional properties to alarms. The will appear in the list as standard properties, unless the module is no longer available, in which case they'll appear as Associated Data. See the documentation of each particular module for more information about how the properties are used.

5.3.4.7 Expression/SQL Properties

DBTags have the ability to use an *expression* or a *SQL query* as their value instead of an OPC item path. This can be used to select information from the database or create your own formulas to manipulate other tag values .

Expression

In expression mode, the tag can use all of the features available in the *expression language*. It can refer to other tags, and use operators and functions to calculate a value for the tag.

See also:

Expressions Overview

SQL Query

In this mode, the tag's value will be the result of the specified SQL query. The query can be any valid

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query, but should result in only one value. Note that insert and update queries can be used, and will often result in an integer value, so the tag's data type should be set accordingly.

Like SQL Query bindings in the Vision module, the queries for tags can refer to other tag values. The values of referenced tags will inserted as literal text in the query before being sent to the database.

5.3.5 Complex Tags (UDTs)

5.3.5.1 Introduction

Complex Tags, also referred to and SQLTag UDTs (user defined types), offer the ability to leverage object-oriented data design principles in Ignition. Using complex tags, you can dramatically reduce the amount of work necessary to create robust systems by essentially creating parameterized "data templates" that can be used to generate tag instances.

Primary Features

Central Definition - Once you define your data type, you can then create instances of it. If at a later time you want to change some aspect of the tag, you can simply edit the type definition, and all instances will be automatically updated.
Parameterized Settings - Define custom parameters on your data type, and then reference them inside your member tags. When it comes time to create instances, you can simply modify their parameter values in order to change where the underlying data comes from.
Extendable - Data types can inherit from other data types in order to add additional members, or override settings. Instances can also override settings, allowing for flexibility for dealing with irregular data and corner cases.

Terminology

Many terms are frequently used when discussing complex tags:
UDT or **UDDT -** User Defined Type or User Defined Data Type. The definition of the data type: its structure, tags, attributes and settings.
Instances - Running copies of a data type, with concrete data for all members. Instances are linked to their parent types, and are reloaded when their parent type changes. Besides specifically overridden settings, all settings are inherited from the type definition.
Parameters - Custom properties on data types that can be used inside the type or instance definition to create parameterized data templates. For example, if a data type consists of 3 OPC tags that only differ by a number in the path, a parameter can be used for the "base address", allowing instances to be created with only 1 setting.
Members - The tags inside of a data type or instance.

5.3.5.2 Defining Data Types

Creating a new data type is very similar to creating standard tags. Simply select **New Data Type** from the tag creation menu to open the editor. When editing complex tags, the tag edit window appears a bit differently. The member structure is presented in the upper left. By selecting a member, the tag property categories are displayed below, and the editor for the selected category appears to the right.

Extending Other Types

Data types can extend other data types, to add additional members, or override default values. The parent data type can be modified by selecting the data type itself in the tag member tree. Note that the

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data type can only be selected when the tag is first created. After that, it is not possible to modify the parent tag type.

Adding Members

To add members to a data type, simply select the type of tag from the toolbar above the member tree. Data types can contain standard tags like OPC and DB, as well as folders and instance of other complex types.

Adding Parameters

Parameters, which can be used for property expansion in member tags, can be added by selecting the data type in the member tree. If a data type contains other complex types in it, there may be various points in the tree with custom parameters. While a data type can override the parameter values inherited from a parent, new parameters can only be added to the root node of the new data type.

Configuring Member Properties

The tags inside of data types are configured much like normal tags. However, in this case, the values can be thought of more as "default values", which will be used unless other values are specified when the instance is created. Most of the values configured in the data type can be modified later in sub types or instances. Furthermore, unlike normal tags, in the context of a data type many properties (general the string based properties) can reference the custom attributes of the type in order to build parameterized types.

Attribute Referencing and Parameterized Types

As mentioned above, many properties in the member tag configuration can reference the parameters available in the data type. When instances are created, these references are replaced with the values defined for the type. Parameter references also support basic offsets and numerical formatting, providing a great deal of flexibility. To reference a parameter, use the syntax "{ParameterName}", or use **CTRL-SPACE** to display a list of available parameters to choose from.

To offset a value, use the form "{ParameterName+offset}".

To format a value, use the form"{ParameterName|format}". The format pattern is the same as that used for the `numberFormat` expression function. In short, "0" can be used to require a digit, and "#" can be used for optional digits.

Example:

For this example, we'll assume that we're parameterizing the OPC Item Path, and that the data type has an integer attribute named "BaseAddress" defined. We'll pretend the opc server provides tags named like "DataPoint1".

Standard referencing

OPC Item Path: `DataPoint{BaseAddress}`

Offset

Imagine that our data type had three fields, and these were laid out sequentially in the device. Instead of specifying each address for each tag, we can simply offset from the base address:

Member 1: `DataPoint{BaseAddress+0}`

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Member 2: `DataPoint{BaseAddress+1}`

Member 3: `DataPoint{BaseAddress+2}`

Formatting (with offset)

Continuing from the example above, imagine that our OPC server actually provided addresses in the form "DataPoint001", in order to stay consistent up to "DataPoint999". This can be accommodated using number formatting in the reference:

Member 1: `DataPoint{BaseAddress+0|000}`

Member 2: `DataPoint{BaseAddress+1|000}`

Member 3: `DataPoint{BaseAddress+2|000}`

This format of three zeros means "three required digits". If our instance has a base address of 98, the resulting paths will be "DataPoint098, DataPoint099, DataPoint100".

Properties that can be parameterized

The following tag properties can reference parameters:

- Value (for string data type only)
- OPC Server
- OPC Item Path
- Tooltip
- Documentation
- Expression/SQL Query
- Bindable Alarm Properties (note: you can bind a property directly to the parameter, or use parameters in the binding expression, or directly in string property values)

Overriding Properties

Sub types and instances can override the properties defined in parent types. To do this, simply select the *override control* (the small grey ball) next to the property to override in the member editor. Conversely, to remove the override, simply unselect the control.

Custom parameters can be overridden as well, but it is not require to specify that the value is an override. Simply provide a new value for the property. For inherited parameters, the "delete" button next to the parameter table will simply remove the override. The parameter can only truly be delete from the type that defines it.

Create Data Types from Existing Tags or OPC

You can save time and quickly generate data types from existing structures. This is particularly useful, for example, when data types are already defined in the PLC.

Converting from existing SQLTags

To create a data type from existing SQLTags, simply select the tags or folders you wish to include, right click, and select "Create Data Type from Selection"

The standard type editor will appear with the selected tags pre-populated as members. From here you can modify the tags, add parameters, etc. The original tags will not be affected. **Tip:** If you select a single folder as the root to create the type from, its sub-members will be added, and its name will

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be the basis for the type (that is, the folder itself won't be included in the structure).

Creating from OPC

If you have data types defined in your PLC (or OPC server), you can short-cut the conversion step outlined above by simply dragging the tags (or the folder for the type) from the OPC Browser directly onto the Data Types folder, and selecting "Create Type" from the subsequent dialog.

5.3.5.3 Creating Instances

Creating instances of complex types is virtually identical to creating other types of tags using the New Tag menu. Unlike standard tags, it is likely that you'll have to modify attribute values or override certain member properties in order to make the instance unique. The process for doing this is equal to that used when creating data types. Once created, instances run very much like standard SQLTags. If the parent data type is updated, the instance will automatically receive the updates and refresh.

Using the Multi-Instance Wizard

The *multi-instance wizard* provides a powerful but simple mechanism for rapidly generating many instances of a data type, by specifying patterns for parameters. To get started, select "Multi-Instance Wizard" from the tag creation window. Once you select a data type, you will see its parameters come into the table below, where you can specify values for them. The size of the parameter patterns dictate how many tags are created, or if only single values are specified, you can choose to create multiple copies of the same configuration.

Value Patterns

In order to define values for parameters (and the tag names), you can use several different types of patterns (and combinations of patterns):

Range `number1-number2[/step]`

A numeric range of values, such as "1-10". Optionally, a "step" parameter can be included, in order to only generate numbers at certain multiples. For example, "0-100/10" would generate 0,10,20, etc.

Repeat `value*count`

A value (numerical or string), and the number of times to use it. For example, "North Area*10" would use the parameter "North Area" for 10 items.

List `value1, value2, value3`

A comma separated list of values (or other patterns) to use.

Examples:

1-10,20-30,30-40	Results in 30 tags being created, with the specified value ranges (so, for example, there would be no parameter "15").
A,B,C	Results in 3 tags, with each of the values.
0-100/5	Results in 21 tags (because range is inclusive), with values 0, 5, 10...100.

As mentioned, the size of the pattern will dictate how many tags will be created. If some patterns are smaller than others, the last value will be repeated for the other tags.

Tag Names

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The names of the generated instances can be specified using a system similar to that of the parameter patterns. If you just want to use sequential names, you don't need to specify a pattern, as values will be generated automatically starting at one. You can also set the pattern to simply be the starting number to generate sequential names from there.

Base Name - A string base for the tag name. This can also be a list of names, in which case the names will be used directly, and the name pattern won't be used.

Name Pattern - A pattern that will be used to generate values that will be appended to the base name.

At any time, you can use the **preview** button to view the tag names and parameters that will be created. Once you are satisfied, click **ok** to generate the tags under the selected folder in the tag provider.

5.3.6 Scan Classes

Scan classes dictate the execution of SQLTags, and therefore play a crucial role in the design of large, high-performance systems. It will often make sense to have more than one scan class. Usually not all of your tags will need to be subscribed at the same rate. Some tags you may wish to see updated at 250-500ms, while others may not be so crucial and may only need to be subscribed at 1500ms. Creating different scan classes allow you to organize your tags into groups that subscribe at different rates. It is good practice to put some forethought and planning into the organization of your SQLTags and scan classes.

Creating and Editing Scan Classes

Scan classes are created by clicking on the *Edit Scan classes* button in the SQLTags browser toolbar. The window will appear with a list of configured scan classes on the left, and configuration settings on the right.

Scan Class Properties

Scan Class Name	Unique name of the scan class.
Mode	Described below
Slow Rate	Base update rate, specified in milliseconds, at which tags will be executed.
Fast Rate	Used by the *Driven* and *Leased* modes, this is the faster rate that the tags will be executed at when those modes are active.
Stale Timeout	How long to wait before the tags in the scan class are determined to be "stale" (not running). This is calculated off of the last expected execution time of the scan class, and is particularly important for scan classes executed by other drivers through the external SQLTags provider. This property is not used by internal providers.
Driven Properties	Used by the *driven* mode to determine when the scan class should run at the fast rate.
Advanced Properties	Settings that subtly affect how the scan class operates.

Note on rates: If the rate is set to 0, the scan class will not be executed. It is common for leased and driven modes to use 0 as a slow rate in order to achieve an "on/off" effect.

Scan Class Modes

Direct

The scan class executes at a fixed rate, defined by the *slow rate* setting.

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Leased
The scan class executes at the fast rate when any of the tags it contains are subscribed and visible in a client window. If no tags are subscribed, the scan class runs at the slow rate.

Driven
The rate of the scan class is based on the value of a driving tag. The condition is a simple comparison between an a tag value and a number. If the condition is true, the scan class will execute at the fast rate. If false, it will run at the slow rate. There are two exceptions to this: the **any change** operator, and **one-shot** mode. Using either of these, the scan class will not run at a rate. Instead, it will be triggered by a change in the driving tag's value. "Any Change" will execute each time the value changes, and "one shot" will execute once when the comparison condition is true, and not again until the condition become false, and subsequently true.

It's useful to keep in mind that the driving tag can be an Expression tag that performs complex calculations and references other tags. In this way, it's possible to create robust scan class triggering.

Advanced Properties

OPC Data Mode
This mode dictates how OPC values are obtained. The default mode, "Subscription", is generally recommended.

Subscribed - All OPC tags in the scan class will be subscribed according to the scan class rate. Values will come in asynchronously as they change.

Read - Tags will not be subscribed, but will instead be synchronously read each time the scan class executes. This operation is less efficient, but allows more precise control over when values are obtained. This mode is particularly useful when collecting data over a slow or expensive connection for display. When combined with the "one-shot" execution mode above, and a static tag tied to a momentary button, it's easy to create a manual refresh button on a screen that pulls data on-demand.

Historical Scan Classes

Historical scan classes are simply standard scan classes used by SQLTags to store history. By utilizing separate scan classes for status and history, it's possible to maintain a tag's status at a fast rate, without storing large amounts of history unnecessarily.

Despite the fact that there is not a technical differentiation between standard and historical scan classes, it is recommended that you create separate scan classes for each purpose and name them in a manner that indicates their usage. It is common to modify scan classes in order to affect a large number of tags, and without a consistent distinction it may be possible to affect tag execution in unexpected ways.

5.3.7 Tag Paths

Tags and their properties can be referenced by a string based path. Each has a unique absolute path, and will often have many equivalent relative paths when referenced from other tags. You will most often generate these by browsing or through drag and drop. However, it's a good idea to understand how tag paths work, particularly if you get into indirect tag binding or scripting.

A tag path will look something like this: `[Source]`*`folder/path/tag.property`*

The italicized portion of the path may contain the following:
A tag

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Any number of nested folders followed by a tag, separated by forward slashes (/).
A period (.) followed by a *property name* after the tag. Omitting this is equivalent to using the .Value property.

Now consider the **[Source]** (portion surrounded by square braces)

Source Option	Meaning	Applicability
`[Tag Provider Name]`	The name of the tag provider that hosts the tag	OPC and Expression tags
`[]` or not specified	The default tag provider for the current project.	OPC, Expression tags
`[.]`	Relative to the folder of the tag that is being bound.	Expression, Client tags
`[~]`	Relative to the tag provider of the tag that is being bound (root node)	Expression, Client tags
`[Client]`	Refers to a client tag	Client
`[System]`	Refers to a system tag	System

Relative Paths

Paths that begin with [.] or [~] are known as *relative paths.* The are used inside SQLTags that bind to other tags, and are relative to the host tag's path. Using the relative path syntax helps avoid problems cause by moving tags and renaming providers. `[~]` refers to the tag's provider root. It can replace the explicit provider name, and thus protect against provider renames and importing/exporting/moving tags between different providers. `[.]` refers to the tag's current folder. By using `[.]`, tags can be moved from folder to folder without problem (provided that all of the applicable tags are moved together).

5.3.8 Data Quality

Data Quality is the measure of how reliable a particular SQLTag's data is. If a tag's quality is not *Good*, the value generally should not be trusted. There are a wide variety of causes of bad data, from network disconnections to software failure, to invalid tag configuration. The quality is a property of the tag (`Quality`), and can be seen in the SQLTags browser. Additionally, bad tag qualities will be reflected in components bound to tags through the *quality overlay* system.

The following table outlines the primary data qualities. There are more values, but these represent the most common:

Quality	Meaning
Good	The data has met all criteria for being considered reliable.
Bad	The data is not reliable, further data isn't available.
Stale	The tag has not been evaluated within the expected time frame. There is likely a deeper problem with the tag provider.
Config_Error	There is a problem with the tag's configuration. The error log may provide more information as to the exact problem.
Comm_Error	There is a problem in communication somewhere between the tag and its data source.
Tag_Exec_Error	There was an error evaluating the tag.
Expression_Eval_Error	The expression in the tag generated an error during execution. The error log should provide more information on the error.
Type_Conversion_Error	The value of the tag could not be converted to the requested data type. Check the assigned data type of the tag.

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OPC_Not_Connected	The OPC server driving the tag is not currently connected OR a value has not yet been received by the tag from the server.
Not_Found	The tag, or a tag referenced from inside of it, could not be found (incorrect reference path).
Driver_Demo_Timeout	The system driving the tag is operating in demo mode and has timed out.
GW_Comm_Off	When viewing SQLTags in the designer, the tags will have this value if communication with the gateway is turned off from the toolbar.
Access_Denied	The tag permission settings do not allow the current user to view the tag.
Disabled	The tag's "enabled" property has been set to *false*.

More information about Quality Overlays.

Tag Quality and Referenced Tags

When tags reference other tags, such as in expressions, they will often pass the worst sub-quality up as their own. For example, even though a particular tag's expression executes without problem, if the expression references a tag whose quality is "Bad", the expression tag will also report "Bad".

5.3.9 Importing/Exporting Tags

It is possible to export and import SQLTags to/from an XML file format using the toolbar on the SQLTags browser window. Simply click the Export button to export, or Import to load a previously exported file.

XML Structure

The basic structure of the xml file is as follows:

```
<Tags>
   <Tag name="..." path="..." type="...">
      <Property name="...">...</Property>
      ...
      <Parameters>
         <Property name="..." type="...">...</Property>
      </Parameters>
      <Alarms>
         <Alarm name="...">
            <Property name="...">...</Property>
            <Property name="..." bindtype="...">...</Property>
         </Alarm>
      </Alarms>
      <Permissions>
               <Entry name="Administrator" hasWriteAccess="false"/>
      </Permissions>
   </Tag>
</Tags>
```

Tag Definition

Tags have three main attributes:
name - The name of the tag.
path - The folder path of the tag
type - The type of the tag (as in its function, not data type), which is one of the following values:

OPC

DB - Note: this is named this way for historical reasons. A "DB" tag is used to define Memory,

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Query, and Expression tags. The difference between these tags is defined by the presence and value of the "Expression" and "ExpressionType" properties (both being absent for memory tags).

Client

Folder

UDT_DEF - Type definition

UDT_INST - UDT Instance definition

EXTENSION - An override of a member defined in a parent type

Property Values

Tags (as well as sub elements, such as parameters and alarms) are defined by a collection of "Property" tags. The property generally consists of a name and value, though in some cases there might be additional attributes available.

Tag Properties

Property Name	Type	Values (if applicable)	Description
Value			The value of the tag, dependant on the data type.
DataType	Int	0 - Int1 1 - Int2 2 - Int4 3 - Int8 4 - Float4 5 - Float8 6 - Boolean 7 - String 8 - DateTime 9 - DataSet	
Enabled	Booelan	true/false	
AccessRights	Int	0 - Read Only 1 - Read/Write 2 - Custom	If custom, will be defined by a "permissions" tag.
OPCServer	String		
OPCItemPath	String		
OPCWriteBackServer	String		"Write back" target for expression tags.
OPCWriteBackItemPath	String		
ScaleMode	Int	0 - Off 1 - Linear 2 - Square Root 3 - Exponential Filter	
ScaleFactor	Float		For exponential filter
RawLow	Float		Defines scale range
RawHigh	Float		
ScaledLow	Float		
ScaledHigh	Float		
ClampMode	Int	0 - None 1 - Low 2 - High 3 - Both	
Deadband	Float		

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DeadbandMode	Int	0 - Absolute 1 - Percentage	
FormatString	String		
EngUnit	String		
EngLow	Float		
EngHigh	Float		
EngLimitMode	Int	0 - None 1 - Low 2 - High 3 - Both	
Tooltip	String		
Documentation	String		
ExpressionType	Int	0 - None 1 - Expression 2 - SQL Query	
DriverName	String		Used for external tags
ScanClass	String		
HistoryEnabled	Boolean	true/false	
PrimaryHistoryProvider	String		The history provider to use if storing history
HistoricalDeadband	Float		
HistoricalDeadbandMode	Int	0 - Absolute 1 - Percentage	
HistoricalScanclass	String		
InterpolationMode	Int	0 - Discrete 2 - Analog (deadband) 3 - Analog (compressed)	How values are interpolated. 2 exists for backwards compatibility (and is equivalent to 1), but only 0 or 3 should be used in the future.
HistoryTimestampSource	Int	0 - System 1 - Value	
HistoryMaxAgeMode	Int	0 - Unlimited 1 - Limited	
HistoryMaxAge	Int		Max cycles between storage.
UDTParentType	String		The path to the parent UDT type. Used by sub-types and instances.

Alarm Properties

Property Name	Type	Values (if applicable)	Description
Enabled	Boolean	true/false	
Priority	String	Diagnostic, Low, Medium, High, Critical	May also be numeric, 0-4.
DisplayPath	String		
ActivePipeline	String		
ClearPipeline			
Deadband	Float		
DeadbandEvalMode	Integer	0 - Absolute 1 - Percentage	
TimeOnDelaySeconds	Float		The "active delay"
TimeOffDelaySeconds	Float		The "clear delay"
TimestampSource	Int	0 - System 1 - Value	

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AckMode	Int	0 - Unused 1 - Auto 2 - Manual	
Notes	String		
AckNotesReqd	Boolean	true/false	
ShelvingAllowed	Boolean	true/false	
Mode	String	Equality Inequality AboveValue BelowValue BetweenValues OutsideValues OutOfEngRange BadQuality AnyChange Bit OnCondition	
SetpointA			The setpoint, or the "low" setpoint for dual value modes.
SetpointB			The "high" setpoint for dual setpoint modes.
InclusiveA	Boolean		
InclusiveB	Boolean		
BitOnZero	Boolean		Used by the "Bit" condition, to indicate that 0 is "active"
BitPosition	Integer		Bit to use in "Bit" condition.
ActiveCondition	Boolean		The property that drives the "OnCondition" mode
AnyChange	Boolean		Whether or not to apply the "any change" behavior in applicable modes.

Binding Alarm Properties
The alarm properties can be bound to tags or expressions. To do this, set the "bindtype" attribute on the property to "Tag" or "Expression". The value will then either be a tag path (absolute or relative), or an expression.

User Defined Data Types (Complex Tags)

Complex tags are more or less defined like normal tags, but with a few important differences:

The tag type will be UDT_TYPE, UDT_INST, or EXTENSION.
The tag may contain nested tags, which will be the members.
Unless it is a top level type definition, the tag will have a "UDTParentType" property defined.
The tag may have a "Parameters" element, which will define the parameters. Each parameter will be a property, but the property may have a "type" attribute to define the type of the parameter. Valid types are "String", "Integer", and "Float".
Parameters are overridden by re-definition in sub-types. In other words, a <Parameters> element in a sub type with the same parameters names will override the parent parameters.
Member tag values are overridden by defining and "extension" tag in sub types.

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5.4 Project Properties

5.4.1 Project General Properties

A project's general properties apply to the project as a whole, across all module functionality. You can edit a project's general properties in the Designer by double-clicking on the `Configuration > Properties` node in the Project Browser, or by navigating to the `Project > Properties` menu.

Note that a few properties of a project, such as its name, description, and title are set in the Gateway by clicking on the *edit* link next to a project under the `Configuration > Projects` section.

Important Concept: Defaults
Project General Properties is where you set the project's *Default Database* and its *Default SQLTags Provider*. It is important to understand how to use defaults effectively for proper project design. Wherever you use a database connection or a SQLTag in a project, you are always given the option to use the project's default, or an explicitly named connection or provider. If your project is like most typical projects, it primarily uses a single database and a single SQLTags provider. By consistently using the "default" option, you make your project more resilient to change.

For example, suppose you have designed a project, and it has a database connection called "Production_DB". Now you want to adapt the project to a new, similar plant, while leaving the existing project intact. You copy the project and create a new database connection, called "New_DB". If your project consistently used it's default database connection, the switchover will be as simple as changing the copied project's default database. However, if you used the explicit "Production_DB" connection in your groups and screens, you will need to laboriously switch the bindings over to "New_DB".

SQLTags Settings
The SQLTags provider chosen here will act as the project's default provider. To use the default provider, simply omit the *source* section of a tag path, or leave it blank, for example: `Path/To/MyTag` or `[]Path/To/MyTag`. The client poll rate is the rate at which a Vision Client or Ignition Designer polls the Gateway for updates to its subscribed SQLTags.

Database Settings
The default database connection to use for this project. To use the default database connection, use the special <*default*> connection, or in scripting, the empty-string connection `""`.

Security Settings
Choose the user source that governs this project's security. This profile will be used for client logins. You may also optionally specify a list of roles that are required for a user to log into this project. Use commas to separate the roles. Users must have *all* of the roles in order to log in. If no roles are specifed, the user only needs to correctly authenticate with the user source in order to log in.

Auditing Settings
If auditing is enabled, audit events will be stored that relate to this project in the chosen audit profile.

Publishing Settings
This is where you configure whether or not a project is split into separate staging and published versions. By choosing "Manual" publish mode, pressing Save in the the Designer will alter the Staging version of the project. The Published version of the project will only be updated when you hit the "Publish" button. If you are in "Auto" publish mode, each save acts like a save followed by a publish, so the two versions are always the same. You can also specify here whether or not commit messages are required, and if so, under what conditions.

See also:
Project Management

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Tag Paths
Security Overview
Project Versioning

5.4.2 Designer General Properties

These properties are used to configure how the designer acts.

Startup Options
You may choose what Comm Mode the Designer starts up in. Learn more in the Communication Modes section.

5.4.3 Designer Window Editing Properties

These options affect the operation of the Designer as it applies to the Vision module's window design.

Default Color Mapping
The color mapping defined here will be the initial color mapping when configuring a new number-to-color property binding.

Default Component Layout
The layout constraints specified here will be the layout constraints used for all newly added components. If you wanted to effectively "disable" relative layout, you would change this setting to Anchored with the North and West anchors selected. Learn more in the Component Layout section.

Component Manipulation
These options affect how the user interface to manipulate components acts. Altering the handle opacity can be helpful when dealing with lots of very small components, so that you can see through the resize handles to align the component perfectly.

Component Bounds
Disabling the constraint on parent bounds allows you to position components outside of their parents bounds, which can be helpful in advanced layouts.

Window Committing
By default, every time you close a window, you are prompted whether or not you wish to *commit* the window. Choosing "yes" will serialize the window and mark its project resource dirty, so that next time you save the project the window will be updated. Choosing "no" will effectively revert all changes to the last time the window was committed. This option allows you to skip the commit prompt, opting to always commit the window on close.

5.4.4 Client General Properties

These properties apply to the Vision Client in general.

Timezone Behavior
The Vision Client can emulate any timezone. By default, it will appear to be in the same timezone as the Gateway. This has the effect of all clients behaving the same, regardless of the timezone setting on the Client's host operating system. Depending on your project's requirements, this may not be optimal. You may have the Client use the host's timezone by choosing the "Client Timezone" option, or you may specify an explicit timezone for all Clients to emulate.

Publish Mode
This setting affects how clients receive updates when the project is saved. The default is *Notify*, which means that all running Clients will display a yellow information bar at the top of their display that notifies the operator that an update is available. The update will be installed when the operator clicks on the yellow bar. You may choose *Push* mode to have updates automatically pushed to all

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running clients with no operator interaction. This is often desirable when a client is running in a situation where keyword and mouse access is inconvenient, such as in a large overhead display.

Touch Screen
All clients can operate in touch-screen mode. When in this mode, clicking on numeric and text entry boxes will pop up on-screen keyboards that can be used for data entry. By enabling touch-screen mode, an operator is given the opportunity to activate the mode on the startup screen. You have the opportunity to control whether or not clients start up with touch-screen mode active by default or not as well. These settings are helpful for mixed-use projects, i.e. those that are launched on both touch-screen devices and traditional computers and laptops.

Data - Tag History Cache
The clients normally maintain a cache of data retrieved from SQLTags History, improving repeat operations on graphs and tables. When this option is disabled, no data is cached, and the full queries execute against the gateway each time data is required.

5.4.5 Client Launching Properties

These properties apply to the Vision Client launch process.

Launch Icon
This image will be used to represent the project on the launch page and desktop shortcut. This needs to be a path to an image that has been uploaded to the Gateway. Use the browse button to choose or upload a new image.

Gateway Launch Page
The default launch mode determines what kind of launch occurs when the user hits the "Launch" button that appears next to the project in the Gateway home page. Each launch mode can also be enabled individually, which will turn the launch button into a split-button, allowing the user to choose the launch mode.

The project can also be hidden from the launch page, which is often useful for projects that are still under development. These projects can still be launched from the Designer's `Tools > Launch` menu.

Java Web Start Properties
These properties affect how the launched project will appear when launched through one of the Java Web Start launch modes: *WIndowed* or *Full Screen*. The *Vendor* and *Homepage* properties will be displayed in the Java Application Manager, which you can find through the Java Control Panel on a Windows computer.

The start maximized button will make the application start in a maximized window. Note that this is not the same thing as *full-screen mode*, which is only available when the client is launched in full-screen mode. In full-screen mode, the width, height, and start maximized properties have no effect.

When launched in full-screen mode, the user will be given an "Exit" button on the login screen by default. For terminals where the application should not be exited, this button can be removed by checking the "Hide Exit Button" checkbox.

Applet Properties
These properties affect how the project appears when launched as a browser applet.

Client Memory
These properties govern how the client uses RAM resources on its host machine. The initial memory setting is how much memory the client will require on startup. While this is typically left alone, boosting it a bit can improve performance somewhat.

The maximum memory setting sets a cap on how much memory the Java VM is allowed to use. This setting can be important for clients that require very large charts, tables and reports. Even if you have launched a client on a machine with plenty of RAM, you'll also need to boost this setting to allow the

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client to use more RAM.

See also:
Image Management
Launching Clients

5.4.6 Client Login Properties

These properties affect how the Vision Client's login process behaves and appears.

Login Screen
These properties affect the appearance of the login screen. By default, the title area of the login screen will contain the project's title (or its name, if the title is blank), along with the project's description. You can override this by entering a welcome message for your project here. You may use HTML to format the message. You can also set an image to use instead of the Ignition logo on the login screen's header. You may also override the text used in the login controls.

Auto Login
By enabling auto-login, you can have the launched client skip the login process. The client will log in behind the scenes using the credentials supplied here. If they fail, the login screen will be presented.

5.4.7 Client Polling Properties

This property affects how the client polls for information.

Important Concept: Polling Rates
Throughout the design of a Vision project, it will be common to have data bindings that run SQL queries. Those bindings all have the option to *poll*, or run repeatedly on a timer. By default, all bindings poll at a rate relative to the *Base Rate*. This is important, because it allows the designer to globally speed up or slow down the rate at which queries are run. This can be helpful when troubleshooting performance problems.

5.4.8 Client User Interface Properties

These properties affect how the Vision Client appears and behaves while it is running.

Minimum Size
Typically, a Vision Client is designed to run on multiple different resolution monitors. The various component layout features help design elastic screens, but sometimes you need to set a lower bound as to how small you'll allow the client's usable area to shrink. This is what the *Minimum Size* settings are for. You can see these settings visually represented in the Designer as lines on the Vision workspace. Whenever the usable space shrinks smaller than these bounds, scrollbars will appear, capping the width and height to these minimums. This defaults to 800x600.

Client Background Color
This option allows you to specify the color of the Vision workspace, which will be visible when not obscured by windows.

Client Menu
These options allow you to alter the appearance, or remove completely, the menu bar that appears in a running Vision Client.

See also:

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Component Layout
Menu Bar Scripts

5.5 Project Scripting Configuration

5.5.1 Script Modules

A project's *Script Modules* are a global library of scripts that can be called from anywhere within the scope of a project. These scripts are organized as named modules that all live under the `app` module. To open the **Script Module Editor** double click on the `Configuration > Script Modules` node in the Project Browser or navigate to the `Project > Script Modules` menu.

Rule of Thumb: Never Copy-and-Paste a Script

If you're unsure of when to put scripts in a script module vs embedding the script directly in an event handler, follow this simple rule. If you ever find yourself copying a script from one event handler to another, *stop* and refactor the script into a global script module! Then simply call your new module from the event handler. This rule will help prevent code duplication across your project, a major maintenance liability.

How to use Script Modules

To add a script module, simply select the `app` package and press the *New Module* button. Each module is a python script that may define many functions. You may also organize modules in sub-packages if you'd like. Lets suppose you added a script module named `myfuncs`, whose body was:

```
def callMe(message):
    import system
    system.gui.messageBox(message)
```

Now, anywhere in your project you can call:

```
app.myfuncs.callMe('Hello World')
```

Whats up with that "`import system`" call?
Frequently in Ignition, your scripts get `system` (the built-in library package in Ignition) and `app` (your project's global script modules) imported for you automatically. Whenever you define a new scope (which you've done with `def`), we can no longer do this for you, and you'll need to import them manually.

See also:
About Python
Scope and Import

5.5.2 Event Scripts

5.5.2.1 Overview

Projects may use scripting to react to a variety of events and actions that occur within the project's lifecycle. There are two major scopes for scripting: Gateway scripts and Client scripts. Gateway scripts execute on the Ignition Gateway, which means that they always execute in one place. Client scripts execute in the client, which means that they may never execute (if no clients are running), or they may execute many times. Client scripts will also execute in the Designer, but only in *Preview Mode*.

Note that these project global event scripts are not to be confused with the component event handler scripts.

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5.5.2.2 Startup and Shutdown Scripts

These script types are available in both Gateway and Client scopes. These scripts will be run when the project starts up or shuts down.

In the Gateway scripting scope, this means that the script will run when the Gateway starts up or is shut down, *and* whenever the scripting configuration changes via a Designer save action. This means that while designing, the startup and shutdown events may happen frequently.

In the Client scripting scope, these scripts run after a user successfully logs in or out, or when the client is closed.

5.5.2.3 Shutdown Intercept Script

This script type is only available in the Client scope. This is a special script that will be called when the user tries to exit or close the client. This script is run with a special `event` variable in its namespace. When the script terminates, if `event.cancel` is `1`, then the shutdown will be aborted, and the client will remain open. Otherwise, the normal shutdown script will be called, and the client will close.

Example

```
if "SuperUser" not in system.security.getRoles():
   system.gui.warningBox("Exit not allowed for non-admin user.")
   event.cancel=1
```

5.5.2.4 Keystroke Scripts

Keystroke scripts are only available in the Client scope. These are scripts that run on a certain key combination. You may add as many keystroke scripts as you'd like, as long as each one has a unique key combination.

When choosing a keystroke, you may choose any number of modifiers, which are keys or mouse buttons that must be down to activate the keystroke. You can also choose whether or not the keystroke is on the *pressed* or *released* event of a keyboard key, or upon the typing of a character. Special keys like the F-keys, ESC, etc, are only available in the pressed and released actions.

5.5.2.5 Timer Scripts

Timer scripts are available in both Gateway and Client scopes. These scripts execute periodically on a fixed delay or rate. Remember that Client timer scripts may never execute (if no clients are open) or may execute many times (once per open client). If you need scripting logic that occurs centrally, make sure you use Gateway scoped scripts.

Fixed delay or fixed rate?
A fixed delay timer script (the default) waits for the given delay between each script invocation. This means that the script's rate will actually be the delay plus the amount of time it takes to execute the script. This is the safest option since it prevents a script from mistakenly running continuously because it takes longer to execute the script than the delay.

Fixed rate scripts *attempt* to run the script at a fixed rate relative to the first execution. If they script takes too long, or there is too much background process, this may not be possible. See the documentation for java.util.Timer.scheduleAtFixedRate() for more details.

Shared thread or dedicated thread?
All timer scripts *for a given project* that choose "Run in shared thread" will all execute in the same thread. This is usually desirable, to prevent creating lots of unnecessary threads. However, if your script takes a long time to run, it will block other timer tasks on the shared thread. The rule of thumb here is

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that quick-running tasks should run in the shared thread, and long-running tasks should get their own thread.

5.5.2.6 Tag Change Scripts

Tag Change scripts are available in both Gateway and Client scopes. Each tag change script can be given a list of tag paths. Whenever one of these tags changes, the tag change script will execute. They will also get an initial execution whenever the scripting system starts up.

Each tag change script can be given a name for organizational purposes. To specify multiple tag for a given script, enter them one per line in the tag paths text area. To quickly import many tags, you can drag-and-drop tags from the SQLTags Browser window onto this text area.

These scripts receive three special variables in their namespace when they are run: `event`, `initialChange` and `newValue`. The `intialChange` variable is a flag (0 or 1) that indicates whether or not this event is due to initially subscribing or not. The `event` variable is a `TagChangeEvent` object, which itself contains the properties: `tag`, `tagPath`, and `tagProperty`. The third, `newValue`, is the new value for the tag property that is subscribed. These values are objects themselves that contain a value, quality, and timestamp. The following example script should be a good starting point.

Example

```
print "Received tag change event for %s" % event.tagPath

value = newValue.value
quality = newValue.quality
timestamp = newValue.timestamp

print "value=%s, quality=%s, timestamp=%s" %(value, quality, timestamp)
```

Tip: The TagPath object that you access via `event.tagPath` is itself a complex object. You can turn it into a string if you want the whole tag path by using the `str()` function. You can also access individual parts of the tag path. The most useful is usually the `itemName` property, which is the name of the tag represented by the path. To get the name of the tag, you can use `event.tagPath.itemName` .

5.5.2.7 Menu Bar Scripts

The Client's menu bar is configured through the Client Event Scripts dialog box. Each node in the menu bar that does not have children executes a script when the user presses it. Most commonly, these scripts will execute navigation actions; opening or swapping a window.

See also:
Typical Navigation Strategy
Client User Interface Properties

5.6 Transaction Groups

5.6.1 Introduction

Transaction Groups are the heart of the SQL Bridge module. They are units of execution that perform a variety of actions, such as storing data historically, synchronizing database values to OPC, or loading recipe values. A variety of group types, items types, and options means that Transaction Groups can be configured to accomplish almost any task.

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The Transaction Group Workspace

Transaction groups are edited through the Ignition designer. When a group is selected, you will be presented with the transaction group workspace.

The workspace is broken into several parts:

1) Title bar - Shows the name of the currently selected group, as well as options to set it as Enabled or Disable, and to Pause, if it's currently executing.
2) Item configuration - Shows all of the items configured in the selected group. Many settings can be modified directly through the display, the rest by double-clicking the item, or selecting "edit" in the context menu.
3) Action / Trigger / Options tabs - Define how and when a group executes. Holds most of the options that apply to the group in general, such as the update rate, and which data connection it uses.
4) Status / Events tabs - Provides information about the executing group, including the most recent messages that have been generated.

Enabling Group Execution

In order for groups to be evaluated, they must first be enabled. This is done by selecting "enabled" in the group title bar, and then saving the project. The group executing can be stopped by reversing the procedure and selecting "disabled" before saving. If you want to quickly and temporarily stop the group's evaluation, toggle the "pause" button. This will prevent execution until the group is un-paused, or until the system is restarted.

Editing Group Settings

Group settings may be modified at any time, regardless of whether or not the group is executing. Modifications will be applied when the project is saved, and the group will be started or stopped as required. Some changes such as modifying items may cause features like live values to appear to be incorrect. It is therefore important to note the modified icon that appears next to the group, and to save often. If you would prefer to stop the group before making edits you can simply pause the group. Execution will begin again after the project is saved.

How Groups Execute

Generally speaking, groups work on a timer. They are set to run at a certain rate, and at that rate, the check the rest of the settings. If the trigger conditions pass, the group is executed fully. The following section provides a fuller outline of the execution cycle.

5.6.2 Execution Cycle

All of the groups follow a similar execution cycle. The core evaluation may differ, but the general cycle is the same.

1) Timer executes, group enters execution
2) Is the group paused? Break execution.
3) Is the Gateway part of a redundant pair? If so, is it active? If not active, break execution. Groups only execute on the active node.
4) Evaluate "run-always" items: OPC items, SQLTag references, and Expression items set to ignore the trigger (or placed in the "run always" section of the configuration window).
5) Is trigger set/active? If there is a trigger defined, but it is not active, break execution.
6) Evaluate "triggered" expression items.

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7) If applicable, read values from the database
8) Execute a comparison between items and their targets
9) Execute any writes to other Tags or the Database that result from execution.
10) Report alerts
11) Acknowledge the trigger, if applicable.
12) Write handshake value, if applicable.

If an error occurs at any stage besides the last stage, execution will break and the failure handshake will be written if configured. The group will attempt execution again after the next update rate period.

5.6.3 Anatomy of a Group

5.6.3.1 Action Settings

The *action settings* of a group define how often the group will be evaluated, as well as important settings that apply to the group as a whole.

They are found on the tab labeled "Action", the first of the tabs on the right side of the Transaction Group workspace.

Common Settings

The settings vary for the different types of groups, but a few setting are common to most of them:

Execution scheduling	How often the group is evaluated. For a number of reasons, the group may not execute during the evaluation. The most common reason is the trigger, but see Execution Cycle for more possible reasons why evaluation will exit.
Data source	The data connection to use for the group. Can be "Default", which will use the default connection for the project.
Update mode	For groups that support it, sets the default for how items are compared to their targets.
Store timestamp	Stores a timestamp along with the data any time the group executes.
Store quality code	Stores an aggregate quality for the group along with the regular data. The aggregate quality is a bit-wise AND of the qualities of the items in the group.

Execution Scheduling

There are two ways to specify when the group should execute: timer mode, and schedule mode.

Timer Mode

In this mode, the group is evaluated regularly at the provided rate. As mentioned in the previous sections, due to trigger settings, full execution may not occur, but the trigger will at least be evaluated at this rate.

Schedule Mode

With schedule mode, you are providing a list of time (or time ranges) that the group should run at. If the pattern specified includes a time range, at rate must be provided, and the group will execute as in timer mode during that period.

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The schedule pattern

The schedule is specified as a comma separated list of times or time ranges. You may use the following formats:

24-hour times. Ie. "8:00, 15:00, 21:00", for execution at 8am, 3pm, and 9pm.

12-hour with am/pm (if not specified, "12" is considered noon): "8am, 3pm, 9pm"

Ranges, "8am-11am, 3pm-5pm"

Notes

It is allowed for time ranges to span over midnight, such as "9pm - 8am"

When using ranges, the execution times will be aligned to the start time. For example, if you specify a schedule of "9am - 5pm" with a rate of "30 minutes", the group will execute at 9, 9:30, 10, etc., regardless of when it was started. This is a useful difference compared to the Timer Mode, which runs based on when the group was started. For example, if you wanted a group that ran every hour, *on the hour*, you could specify a 1 hour rate with a range of "0-24".

5.6.3.2 Trigger and Handshake Settings

The trigger settings determine when a group will actually execute. They are examined each time the group evaluates (according to the *update rate* of the group). If they pass, the group will run and perform its action against the database.

The trigger settings are the same for all group types. They are found on the second tab (labeled "Trigger"), in the right side of the Transaction Group workspace.

Only execute when value have changed (asynchronous trigger)

These settings are evaluated first. If set, the group will examine whether the values in the specified tags have changed, and if not, will exit evaluation.

It is possible to monitor all *Run-Always* tags in the group, or only specific ones.

Execute this group on a trigger

Enables trigger on a specific item in the group. The trigger item can be any *Run-Always* item, such as an OPC item, SQLTag reference, or an Expression item set to "Run-Always" mode.

In addition to the numeric settings that define the trigger, there are several other options:

Only execute once while trigger is active - The group will only execute once when the trigger goes into an active state, and will not execute again until the trigger goes inactive first. If unselected, the group will execute each time the trigger conditions evaluate to true.

Reset trigger after execution - If using the ">0" or "=0" trigger modes, the trigger can be set to write an opposite value after the group has executed successfully. This is useful for relaying the execution back to the PLC.

Prevent trigger caused by group start - If selected, the group will not execute if the trigger is active on the first evaluation of the group. In the course of designing a group, it is common to stop and start it many times, and sometimes it is not desirable to have the group execute as a result of this. Selecting this option will prevent these executions, as well as executions caused by system restarts.

Handshake Settings

Group handshakes are also defined on the trigger tab. It is possible to specify both a success and

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failure handshake. The success handshake will write the specified value to the given item when the group has finished all other triggered execution without error.

The failure handshake, on the other hand, will be written when the group execution is cut short due to an error, such as an error writing to the database or an item.

5.6.3.3 Advanced Settings

Transaction groups offer several advanced settings that affect how execution occurs. These settings can be found under the **Options** tab for a group.

OPC Data Mode
This setting modifies how the group receives data from OPC.

Subscribe - Data points are registered with the OPC server, and data is received by the group "on-change". This is the default setting and generally offers the best performance, as it reduces unnecessary data flow and allows the OPC server to optimize reads. However, it's important to note that data is received by the group *asynchronously*, meaning that it can arrive at any time. When the group executes, it "snapshots" the last values received and uses those during evaluation. If some values arrive after execution begins, they will not be used until the following execution cycle.

Read - Each time the group executes it will first read the values of OPC items from the server. This operation takes more time and involves more overhead than subscribed evaluation, but ensures that all values are updated together with the latest values. It is therefore commonly used with batching situations, where all of the data depends on each other and must be updated together. It's worth noting that when using an OPC item as the trigger, the item will be subscribed, and the rest of the values read when the trigger condition occurs. Note: This option was previously referred to as "polled reads" in earlier versions of the software.

Bypass Store and Forward System
Only applicable to groups that insert rows into the database. Causes groups to target the database directly instead of going through the store-and-forward system. If the connection becomes unavailable, the group will report errors instead of logging data to the cache.

Override OPC Subscription Rate
Specifies the rate at which OPC items in the group will be subscribed. These items are normally subscribed at the rate of the group, but by modifying this setting it is possible to request updates at a faster or slower rate.

5.6.3.4 Items Types

5.6.3.4.1 Overview

Items are the core elements of a group. They are executed, and the values are then used by the group for logic purposes, by other items, and to write to the database. They can be written to from the database or from other items.

Type of Item	Description
OPC Item	Directly subscribed to an OPC server at the rate of the group. Executed by the group, so alerts are evaluated when the group is executed. These items are executed even when the trigger isn't active.
Run-Always Expression Item	Much like an expression SQLTag, can be either a static value, an expression, or a database query. Run-Always expression items are

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	evaluated at each group interval, before the trigger state is evaluated.
Triggered Expression Item	Same as Run-Always expression items, except that they are only executed after the trigger has been evaluated and is active.
SQLTag Reference	A reference to a SQLTag. Allows a SQLTag to be used in a group like any other item type, except that the tag is evaluated by its scan class instead of by the group. See *SQLTags vs. OPC Items* below for more information.

Execution Order

Items generally aren't executed in a reliable order, with the exception of Expression items. Expression items can be ordered using the up and down arrows located to the right of the list where the items are displayed. This can be crucial for performing complex operations that require a specific sequence.

SQLTags vs. OPC items in Groups

It is easy to confuse the definition and purpose of SQLTags and OPC items in transaction groups, though they have distinct benefits.

SQLTags may be referenced inside of groups, however it is critical to remember that they are executed by the Ignition gateway, according to their scan classes, and independently of the group. Adding a SQLTag into a group is like creating a shortcut to that tag. However, once in the group, the item can be used like any other item. That is, it may be mapped bi-directionally to the database, used as a trigger, be the target of another item, etc. It is even possible to create an hour meter out of the item. Core properties of the tag such as alerting and scaling, however, are defined in the actual SQLTag, not in the group.

OPC Items in groups (as well as expression items in groups), however, are completely executed by the group. They do not exist outside of the group in which they are defined. They are subscribed and evaluated according to the rate of the group.

Generally speaking, it is most common to create OPC items in groups, even if a particular point might already exist in SQLTags. This leads to more understandable group execution, as all evaluation occurs in the group according to the timer and trigger settings. SQLTag references are useful when it is necessary to have a single value in multiple groups, for example, as a trigger in order to coordinate execution.

5.6.3.4.2 OPC Item

OPC Items are the backbone of a group. They get their values from PLCs and the values are then used by other items the group and/or to write to the database. They are directly subscribed to an OPC server at the rate of the group and are executed by the group so their alerts are evaluated when the group is executed. These items are executed even when the trigger isn't active.

OPC Item Properties

General:

General Properties

Name - The name of the OPC item in the group. There cannot be duplicate names within a group.

Datatype - The datatype used to read values from the PLC.

OPC Properties

Clicking on the **Browse OPC...** button in this section will allow you to select the tag you want and

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Ignition will fill out the following fields for you.

OPC Server - The Selected OPC Server. This is a dropdown list showing all the OPC Servers added in the Ignition Gateway.

OPC Item Path - The OPC Item's address Including Device name or Channel if required.

Value Mode

Property - Which property of the OPC item you want to use.

1) Value - Item value
2) Quality - Quality code from OPC Server (192 = GOOD_DATA)
3) Timestamp - The last time the item value changed
4) Name - The SQLBridge Item Name property of this Item.

Mode - Options for displaying values based on the Item value.

1) Direct Value - Item value
2) Hour Meter - Record the amount of time the Item value is non-zero. This accumulation will reset to zero when the item value goes to zero. The datatype should be set to integer or float when using an Hour Meter regardless of the OPC Item type.
   On Zero - Use a zero value to accumulate time instead of a non-zero value
   Retentive - Retain the Hour Meter value when it is not accumulating.
   Units - The time units to display.
3) Event Meter - Record the number or times the Item value is non-zero. The datatype should be set to integer when using an Event Meter regardless of the OPC Item type.
   On Zero - Use a zero value to accumulate events instead of a non-zero value

Write Target

Mode - Changes the items directional read/write option.

1) Use group's mode - Inherit the Update Mode from the Item's Group.
2) OPC to DB - Only read from the OPC server and write to the database.
3) DB to OPC - Only read from the database and write to the OPC Server.
4) Bi-directional OPC wins - Read and Write to both the database and OPC Server. On group start, write OPC Server values to the database.
5) Bi-directional DB wins - Read and Write to both the database and OPC Server. On group start, write database values to the database.

Target Type - This is the selection for what the Item will write to when the group executes.

1) None, read-only item - Do not write this value to the database.
2) Database field - Write the Item value to the specified column in the database table. This list will populate with all the column names from the Group's target table after the first time the group is run.

Target Name - The name of the column in the database that this Item will write to when the group executes. The Target Name list will populate with all the column names from the Group's target table if the Target Type is Database field.

Alerting:

Alerting settings for the OPC items. See SQLTags Alerting for a full explanation.

5.6.3.4.3 Expression Item

Expression Items are used for executing comparisons, simple math and querying additional database tables. They get their values from an expression made up of static values or other items, or from SQL Queries. They can have alerts and can be executed when the trigger is active or every time the group executes.

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Expression Item Properties

General:

General Properties

Name - The name of the OPC item in the group. There cannot be duplicate names within a group.

Value - The static value of this Expression item. This will be overwritten by an Expression/SQL binding.

Datatype - The datatype values are stored as.

Value Mode

Property - Which property of the OPC item you want to use.

1) Value - Item value
2) Quality - Quality code of the expression/SQL Query (192 = GOOD_DATA)
3) Timestamp - The last time the item value changed
4) Name - The SQLBridge Item Name property of this Item.

Mode - Options for displaying values based on the Item value.

1) Direct Value - Item value
2) Hour Meter - Record the amount of time the Item value is non-zero. This accumulation will reset to zero when the item value goes to zero. The datatype should be set to integer or float when using an Hour Meter regardless of the OPC Item type.
   On Zero - Use a zero value to accumulate time instead of a non-zero value
   Retentive - Retain the Hour Meter value when it is not accumulating.
   Units - The time units to display.
3) Event Meter - Record the number or times the Item value is non-zero. The datatype should be set to integer when using an Event Meter regardless of the OPC Item type.
   On Zero - Use a zero value to accumulate events instead of a non-zero value

Evaluation Mode

Run-always (ignore Trigger) - When selected, this causes the group to evaluate at each group interval, before the trigger state is evaluated.

Write Target

Target Type - This is the selection for what the Item will write to when the group executes.

1) None, read-only item - Do not write this value to the database.
2) Database field - Write the Item value to the specified column in the database table.
3) Other tag - Write the Expression Item's value back to an OPC item or SQLTag Reference.

Target Name - The name of the column in the database that this Item will write to when the group executes. The Target Name list will populate with all the OPC Item and SQLTag Reference names from this Group, or the column names from the Group's target table depending on the Target Type selected.

Numeric:

Numeric properties for Expression Items. See SQLTags Numeric Properties for a full explanation.

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Alerting:

Alerting settings for the OPC items. See SQLTags Alerting for a full explanation.

Expression:

Expression/SQLQuery options for Expression Items. See SQLTags Expression/SQL Properties for a full explanation.

5.6.3.4.4 SQLTag Reference

SQLTag References are used just like OPC Items, adding the convenience of using a SQLTag that has already been set up with scaling and alarm data.

SQLTag Reference Properties

General:

General

Tag Path - The path to the tag being referenced. This value is not editable except by clicking the Insert Tag button. There cannot be duplicate names within a group.

Data Type - The datatype to write to into the database if this item is not read-only.

Value Mode

Property - Which property of the SQLTag you want to use.

1) Value - Item value
2) Quality - Quality code of the SQLTag (192 = GOOD_DATA)
3) Timestamp - The last time the item value changed
4) Name - The SQLBridge Item Name property of this Item.

Mode - Options for displaying values based on the Item value.

1) Direct Value - Item value
2) Hour Meter - Record the amount of time the Item value is non-zero. This accumulation will reset to zero when the item value goes to zero. The datatype should be set to integer or float when using an Hour Meter regardless of the OPC Item type.
   - On Zero - Use a zero value to accumulate time instead of a non-zero value
   - Retentive - Retain the Hour Meter value when it is not accumulating.
   - Units - The time units to display.
3) Event Meter - Record the number or times the Item value is non-zero. The datatype should be set to integer when using an Event Meter regardless of the OPC Item type.
   - On Zero - Use a zero value to accumulate events instead of a non-zero value

Write Target

Mode - Changes the items directional read/write option. This is only editable when the target Type is set to Database field.

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1) Use group's mode - Inherit the Update Mode from the Item's Group.
2) OPC to DB - Only read from the OPC server and write to the database.
3) DB to OPC - Only read from the database and write to the OPC Server.
4) Bi-directional OPC wins - Read and Write to both the database and OPC Server. On group start, write OPC Server values to the database.
5) Bi-directional DB wins - Read and Write to both the database and OPC Server. On group start, write database values to the database.

Target Type - This is the selection for what the Item will write to when the group executes.
1) None, read-only item - Do not write this value to the database.
2) Database field - Write the Item value to the specified column in the database table.

Target Name - The name of the column in the database that this Item will write to when the group executes. The Target Name list will populate with all the column names from the Group's target table if the Target Type is Database field.

5.6.4 Types Of Groups

5.6.4.1 Standard Group

The *standard group* is called such because it's a flexible, general use group that can be adapted to a variety of situations. The data model is *row based*, with items mapping to columns and the data corresponding to a specific row of a table.

General Description

The standard group contains items, which may be mapped to the database, or used internally for features such as triggering or handshakes. Items that are mapped to the database target a specific column of a single specific row, chosen according to the group settings. Items can be mapped in a one-way fashion, or bi-directionally, in which the value of the database and the item will be synchronized.

The group may also insert new rows instead of updating a specific row. In this manner, data can be inserted for historical purposes based on a timer, with an optional trigger.

Group Settings

The standard group uses a timer-based execution model shared by all groups, and the normal trigger settings.

Additionally, there are several settings specific to the group type:

Automatically create table - If the target table does not exist, or does not have all of the required columns, it will be created/modified on group startup. If not selected and the table doesn't match, an error will be generated on startup.

Store timestamp - Specifies whether or not to store a timestamp with the record, and the target column. The timestamp will be generated by the group during execution. For groups that update a row, the timestamp will only be written if any of the values in the group is also written.

Store quality code - If selected, stores an aggregate quality for the group to the specified column. The aggregate quality is the combined quality of all of the items that write to the table. For more information about quality values, see Data Quality

Delete records older than - If selected, records in the target table will be deleted after they reach the specified age. This setting is useful for preventing tables from growing in an unbounded manner,

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which can cause disk space and performance problems over time.

Table action - This section details how the group interacts with the table. The group can insert a new row each execution, or update the first, last or custom record. A custom update clause is essentially the where clause of the SQL query that will be generated to read and write the group. In addition to standard SQL syntax, you can bind to items in the group in order to inject dynamic values.

Typical Uses

Standard groups can be used any time you want to work with a single row of data. This can include:

Historical logging - set the group to insert new records, and log data historically either on a timer, or as the result of a trigger. Flexible trigger settings and handshakes make it possible to create robust transactions.

Maintain status tables - Keep a row in the database updated with the current status values. Once in the database, your process data is now available for use by any application that can access a database, dramatically opening up possibilities.

Manage recipes - Store recipe settings in the database, where you have a virtually unlimited amount of memory. Then, load them into the PLC by mapping DB-to-OPC using a custom where clause with an item binding in order to dynamically select the desired recipe.

Sync PLCs - Items in the group can be set to target other items, both for one-way and bi-directional syncing. By adding items from multiple PLCs to the group, you can set the items of one PLC to sync with the others. By creating expression items that map from one PLC item to the other, you can manipulate the value before passing it on.

5.6.4.2 Block Group

The *block group* is so named because it writes "blocks" of data to a database table, consisting of multiple rows and columns.

General Description

A block group contains one or more block items. Each block item maps to a column in the group's table, and then defines any number of values (OPC or SQLTag items) that will be written vertically as rows under that column. The values may be defined in the block item in two modes. The first, List mode, lets a list of value-defining items to be entered. These value items may either by OPC items, SQLTag items, or static values. The second mode, Pattern mode, can be useful when OPC item paths or SQLTag paths contain an incrementing number. You may provide a pattern for the item's path, using the wildcard marker `{?}` to indicate where the number should be inserted.

Block groups are very efficient, and can be used to store massive amounts of data to the database (for example, 100 columns each with 100 rows- 10,000 data points- will often take only a few hundred milliseconds to write, depending on the database). They are also particularly useful for mirroring array values in the database, as each element will appear under a single column, and share the same data type.

Like the standard group, the block group can insert a new block, or update the first, last or a custom block. Additionally, the group can be set to only insert rows that have changed in the block.

In addition to block items, the group can have other OPC items, SQLTag references, and Expression items. These items can be used for triggers, handshakes, etc. They may also target a column to be

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written, and will write their single value to all rows in the block.

Group Settings

Beyond the differences in the data, namely that the block group works with multiple rows instead of just 1, this group type shares many similarities with the Standard Group.

The unique settings are:

Store row id - Each row will be assigned a numeric id, starting at 0. If selected, this id will also be stored with the data.

Store block id - If selected, an incremental block id will be stored along with the data. This number will be 1 greater than the previous block id in the table.

Insert new block vs. Insert changed rows - If "insert new block" is selected, each row of the block will be inserted when the group executes, even if the data has not changed. By contrast, "insert changed rows" will only insert the rows that have new data. The latter mode is particularly useful for recording history for many data points on a "on change" basis, provided there is a unique id column defined. The "store row id" feature is useful for this, as well as the ability to reference the item path in an item's value property.

Update Custom block - Like standard groups, this setting allows you to target a specific section of the table, using SQL where clause syntax, with the ability to bind to dynamic item values. Unlike standard groups, however, the where clause specified should result in enough rows to cover the block. Excess rows will not be written to, but fewer rows will result in a group warning indicating that some data could not be written.

Typical Uses

Block groups are useful in a number of situation where you need to deal with a lot of data efficiently.

Mirroring/Synchronizing array values to DB - Arrays are often best stored vertically, which makes them perfect for block groups. Pattern mode makes configuration a breeze by allowing to you specify the array as a pattern, and set the bounds.

Recipe management - Like standard groups, but when set points are better stored vertically than horizontally.

Vertical history tables - Group data points by data type (int, float, string), create a copy of the item that stores item path, and then use the insert changed rows option to create your own vertically storing historical tables. Create additional copies of the block item that refer to quality and timestamp in order to get further information about the data point.

5.6.4.3 Historical Group

The historical group makes it easy to quickly log data historically to a SQL database.

General Description

The historical group inserts records of data into a SQL database, mapping items to columns. Full support for triggering, expression items, hour & event meters and more means that you can also set up complex historical transactions. Unlike the standard group, the historical group cannot update rows, only insert. It also cannot write back to items (besides trigger resets and handshakes).

Group Settings

The settings of the historical group are identical to the settings in the Standard Group, but limited to inserting rows.

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Typical Uses

Basic historical logging - Recording data to a SQL database gives you incredible storage and querying capabilities, and makes your process data available to any application that has DB access.

Shift tracking - Use an expression item to track the current shift based on time, and then trigger off of it to record summary values from the PLC. Use a handshake to tell the PLC to reset the values.

5.6.4.4 Stored Procedure Group

The *stored procedure group* lets you quickly map values bi-directionally to the parameters of a stored procedure.

General Description

The stored procedure group is similar to the other groups in terms of execution, triggering, and item configuration. The primary difference is that unlike the other group types, the target is not a database table, but instead a stored procedure.

Items in the group can be mapped to input (or inout) parameters of the procedure. They also can be bound to output parameters, in which case the value returned from the procedure will be written to the item. Items can be bound to both an input and output at the same time.

Group Settings

The stored procedure group's settings look and act the same as those of the Historical Group. The primary difference, of course, is that instead of specifying a table name and column names, you'll specify parameter names.

Parameters may be specified using either **parameter names** or **numerical index.** That is, in any location where you can specify a parameter, you can either use the name defined in the database, or a 0-indexed value specifying the parameter's place in the function call. **Important:** You cannot mix names and indices. That is, you must consistently use one or the other.

If using parameter names, the names should not include any particular identifying character (for example, "?" or "@", which are used by some databases to specify a parameter).

Typical Uses

Call stored procedures - The stored procedure group is the obvious choice when you want to bind values to a stored procedure. It can also be used to call procedures that take no parameters (though this can also be accomplished from Expression Items/SQLTags.

Replace RSSQL - The stored procedure group is very popular among users switching from RSSQL, given that application's heavy use of stored procedures.

Known Issues

When using Oracle, you must use indexed parameters.

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5.7 Windows, Components, and Templates

5.7.1 Introduction

Windows, Components, and Templates

Windows, components, and templates are the fundamental building blocks for projects using the Ignition Vision module. A Vision project is a collection of Windows. These windows get loaded into the Vision Client, where any number of them may be open at once. A window itself is a hierarchy of components. Components range in complexity from the humble Button and Label, all the way to the powerful Easy Chart and Table components. Shapes such as a line or a rectangle are also considered components, but have some additional capabilities such as the ability to be rotated.

Templates are components that can be re-used across many windows. They are designed separately, outside of any window. After being designed, they can be added to any of the windows within a project. The true power of a template is that if you change its design, all uses of that template across all windows will reflect those changes. This gives templates a major advantage over a copy-and-paste style of design.

Windows, components, and templates are designed visually with a drag-and-drop interface in the Ignition Designer. Components each have a host of properties that govern how the component looks and behaves. Components are brought to life through the combination of property binding and event handlers. These concepts should be generally familiar to anyone who has used a programming or RAD tool like Visual Basic or MS Access. Property binding is the technique of binding a component's property to something else that is changing, such as a tag or the results of a database query. Event handlers are a way to use scripting to react to *events* that the component fires, such as mouse or keyboard events.

The Window Workspace

When a window on template is selected in the Ignition Designer, the *window workspace* will become visible. Inside this workspace are all of the windows and templates that are currently open. Each open window gets its own editing workspace, and you switch between windows with the tabs on the bottom. It is also standard to have a component palette panel and the property editor panel open.

Whenever you hit **Save** in the Designer, all open windows are committed and the whole project is saved. Note that even when working in other workspaces, for example the Transaction Group Workspace, any open windows will be committed and saved when you hit **Save**.

Whenever a project resource that is applicable in the Client scope (such as a Window or the Client Scripting configuration) is changed, all running clients get an update notification, or start running the new version of the project if the project is in Push update mode. To alter this behavior, you can put your project in manual publish mode. See Project Versioning for more information.

Preview Mode

The window workspace operates in two distinct modes: design mode and preview mode. You may switch between these modes with the play/stop buttons in the toolbar or the `Project > Preview Mode` menu item. You may also use the `F5` key to toggle between the two modes.

In design mode, your mouse is used to manipulate components in a window. You can select, drag, and resize them. You may alter data bindings and event script configuration. Data bindings are active in design mode, but event handlers are not.

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In preview mode, you are interacting with a "live" version of the window. Property bindings and event handlers will run, just like in the Client.

Preview mode is useful for a quick check of the operation of a window, but it becomes cumbersome when trying to test a whole project. For that, we recommend having a launched Client up as well, and doing testing in the true Client. You can quickly launch a client in one of the three launch modes via the `Tools > Launch Project` menu.

5.7.2 Windows

5.7.2.1 Windows Overview

Creating Windows

Creating windows is a easy as pressing the **New Window** button in the toolbar, or by navigating to the `File > New > Window` menu. There are three types of windows you can create: a main window, a popup window, or a docked window. These three windows are described in the typical navigation strategy page.

Naming and Organization

Use the Project Browser panel to rename a window by right-clicking on it and choosing Rename, or by pressing F2. You can also create folders to organize your windows. A window's name must be unique among the windows in its folder. A window's name and folder path is very important - it will be how other windows reference it.

Window Notes

Through the right-click menu on a window in the Project Browser you can access the window's notes. This free-form text field is provided to let the designer document the purpose and any technical information about how the window works.

Importing and Exporting

You may import and export windows to external files by using the right-click menu in the Project Browser. Simply select the windows in the export wizard that you'd like to export, and choose a path for the resulting `*.vwin` file.

5.7.2.2 Anatomy of a Window

Name and Path

Windows are the top-level unit of design for Vision projects. A window is identified by its path, which is the name of all its parent folders plus its name, with forward slashes (`/`) in between. For example, the path to a window in the top level called `MainWindow` would simply be its name, whereas the path to a window named `UserOptions` under a folder called `OptionsWindows` would be: `OptionsWindows/UserOptions`.

Titlebar and Border

A window may display a titlebar and/or a border. The titlebar allows the user to drag the window around, and houses the window's close and maximize/restore buttons. The border of a window can be used to resize the window when it is floating or docked. Whether on not the titlebar and border are displayed depends on the values of the window's titlebar and border display policy properties, and its current state. Commonly, a window will display both a titlebar and border when it is floating, but only a titlebar when maximized. It is often desirable to remove titlebars and borders on maximized windows.

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Root Container

Inside a window is always the *root container*. This is a normal container component except that it cannot be deleted or resized - its size is always set to fill the entire window. The root container is where you will place all of your components in the window.

5.7.2.3 Window Types

Windows come in three flavors. By manipulating a window's properties, you can transform any window into various configurations. You can alter a window's *Dock Position*, *Border Display Policy*, *Titlebar Display Policy*, and *Start Maximized* properties to change it into one of three categories.

Main Windows

A "main window" window is one that is set to *start maximized*, and has its *border* and *titlebar* display policies set to `When Not Maximized` or `Never`. This will make the window take up all available space (minus space used by any "docked" windows). This makes the window act much like a typical "HMI screen." There can by many main windows in a project, but only one should be open at any time.

Popup Windows

A "popup window" is a window whose `Dock Position` is set to `Floating` and is not maximized. Its *border* and *titlebar* display policies are usually set to `When Not Maximized` or `Always`, so that they can be manipulated by the end-user. These windows are often opened by components in a main window, and are meant to be on top of the screen. To this end, they may have their *Layer* property set to a number higher than zero so they don't get lost behind the main window. To get a window to pop-up at a specific position, edit the Window's `Starting Location` property.

Popup windows are often *parameterized* so they can be re-used.

Docked Windows

A "docked window" is one whose `Dock Position` is set to anything but `Floating`. This will make the window stick to one side of the screen, and nothing can overlap it. It will also typically have its *border* and *titlebar* display policies set to `Never`. This makes the "docked" window appear to be joined seamlessly with the current "screen" window.

These screens are usually tall and skinny or short and wide, depending on the side they're docked to. The purpose of a docked window is to make some information always available; typically navigation controls and overall status information. Using docked windows can help eliminate repetitive design elements from being copied to each screen, making maintenance easier.

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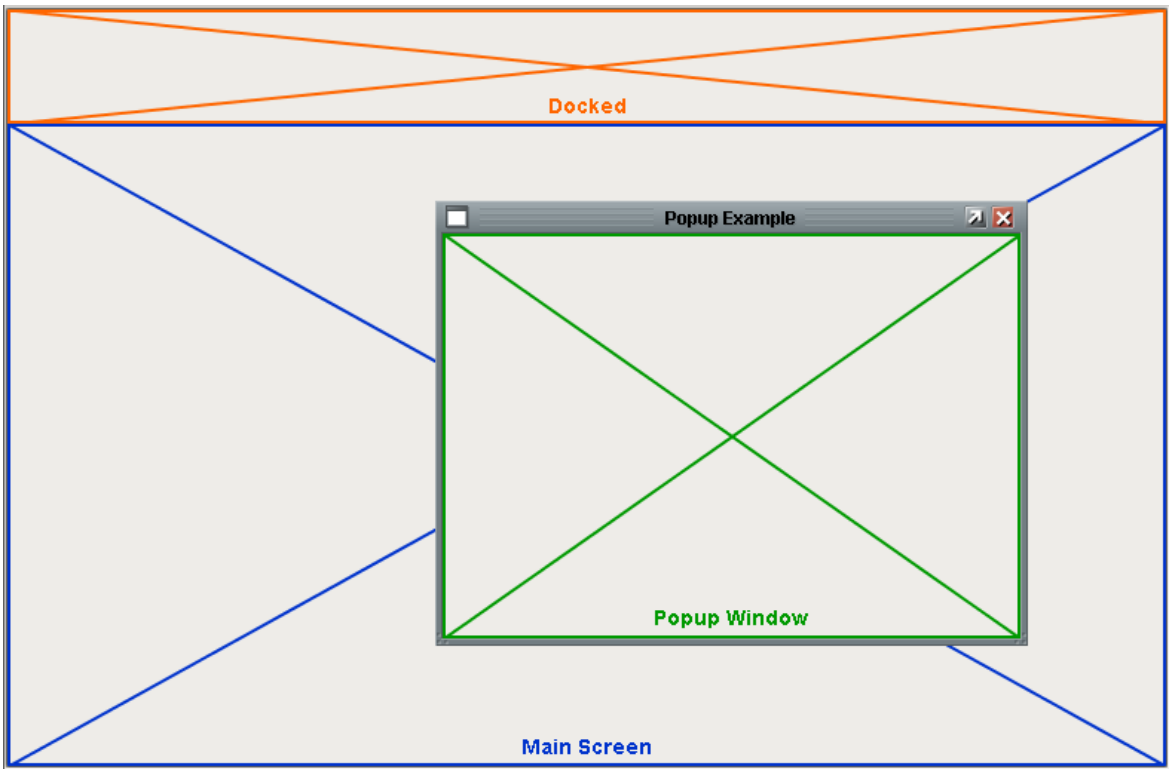

See also:
Typical Navigation Strategy
Parameterized Windows

5.7.2.4 Window Properties

Special Properties

Windows have some special properties that you can edit while the window is closed. These properties are modified by right-clicking on the window in the Project Browser.

Name	The name of the window. Must be unique in its folder.
Open on Startup	Windows with this property set to true will be opened when the project starts up in the Vision Client.
"About" Window	At most one window per project may specify an "about" window. This will cause an "About this Application" menu item to appear in the "Help" menu in the Client, which opens the appropriate window.

Dynamic Startup Windows
Sometimes a project needs to alter its startup windows depending on who logged in, what security roles the have, or what computer the client is launched on. In these cases, simply set no startup windows, and write a Client Startup Script that uses the `system.nav` library to open the correct windows.

Standard Properties

These properties are modified in the Property Editor panel, just like a component's properties. Simply select the window either by clicking on its title bar, or clicking on the window's node in the Project Browser while it is open to select it in the Property Editor.

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Appearance

Title

The title to be displayed in this window's titlebar.

Scripting name	`title`
Data type	String

Border Display Policy

Determines if window's border is shown in various window states.

Scripting name	`borderDisplayPolicy`
Data type	int
Values	**0** Always **1** Never **2** When Not Maximized

Titlebar Display Policy

Determines if window's titlebar is shown in various window states.

Scripting name	`titlebarDisplayPolicy`
Data type	int
Values	**0** Always **1** Never **2** When Not Maximized

Titlebar Height

The height of the window's titlebar.

Scripting name	`titlebarHeight`
Data type	int

Titlebar Font

The font of the window title in the titlebar.

Scripting name	`titlebarFont`
Data type	Font

Behavior

Dock Position

Determines the position this window is docked to, or if it is floating.

Scripting name	`dockPosition`
Data type	int
Values	**0** Floating **3** West **4** South **2** East **1** North

Closable

Determines whether or not to draw the close (X) button in the upper right corner.

Scripting name	`closable`
Data type	boolean

Maximizable

Determines whether or not to draw the maximize button in the upper right corner.

Scripting name	`maximizable`
Data type	boolean

Resizeable

Determines whether or not to let the user resize the window.

Scripting name	`resizable`
Data type	boolean

Start Maximized

When set to `true`, the window will become maximized when it is opened.

Scripting name	`startMaximized`
Data type	boolean

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Cache Policy

By default this property is set to `Auto`, which keeps a window in a memory cache for a while after it is closed, so that if it is opened again it will be quick. The window isn't "active" while it is closed: all of its bindings and scripts are shut down.

Setting this property to `Never` causes a fresh copy of the window to be deserialized every time it is opened. This is a performance hit, but it also is a convenient way to "clear out" the values of the window from the last time it was opened, which can be helpful in data-entry screens.

Setting the property to `Always` will trade memory for higher performance, causing the window to always remain cached after the first time it is opened. This means the window will open very fast, but your Client will need lots of memory if you do this to a large amount of windows.

Scripting name	`cachePolicy`
Data type	int
Flags	expert
Values	0 Auto 1 Never 2 Always

Layout

Location

The location that this window will open up at. Only applicable to floating windows that are not set to start maximized. Also, you must un-check the "Center Window" checkbox on the open-window navigation action in order for this location to take effect

Scripting name	`startingLocation`
Data type	Point

Size

The dimensions of the window. This can be manipulated by selecting the window and dragging the resize handles along the windows right and bottom edges.

Scripting name	`size`
Data type	Dimension

Minimum Size

The minimum size that this window will allow itself to be resized to.

Scripting name	`minimumSize`
Data type	Dimension
Flags	expert

Maximum Size

The maximum size that this window will allow itself to be resized to.

Scripting name	`maximumSize`
Data type	Dimension
Flags	expert

Layer

Sets the layer that this window is in. Default layer is 0, which is the bottom layer. Windows in higher layers will always be shown on top of windows in layers beneath them.

Scripting name	`layer`
Data type	int
Flags	expert

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5.7.2.5 Window Security

You can configure security settings that control who can and who can't open a window. While the window is open, select it by clicking on the title bar or selecting its node in the Project Browser. Then navigate to the `Component > Component Security` menu. Window security is configured the same way that Component Security is configured.

5.7.2.6 Typical Navigation Strategy

Make sure you understand the Window Types topic before reading this topic.

The typical navigation strategy for a Vision project is to have a "docked" window or two (usually docked north and/or west), and then have a single main window visible at a time. *Swap* navigation is used to swap between the main windows. This ensures that only one main window is open at a time. Standard *open* navigation is then used to open various "popup" windows as necessary.

This style of project is so common, that the default operation of the Tab Strip component expects it. When it is in its default automatic operation, it expects that each tab represents a "screen" window, and will automatically swap from the current screen to the desired screen. Furthermore, the `[System]/Client/User/CurrentWindow` tag is calculated based upon this strategy: its value is the name of the current maximized window.

This navigation strategy is used in the "ExampleProject" that you can download from our website.

5.7.2.7 Swapping vs Opening

There are two primary window navigation operations: *swapping* and *opening*.

Opening and Closing

Opening and closing are the basic window navigation options. Opening a window opens the window at the same size it was the Designer, unless the *Start Maximized* property is `true` or the *Dock Position* is not `Floating`. To have a floating popup window open at a specific location, make sure to set the *Location* property of the window in the Designer. If the window was recently open, it will open in its last state due to window caching. See the Cache Policy property for more information.

Swapping

In general, swapping involves closing one window, and then opening another window in its place. This operation can be performed on window in any state: docked or floating, maximized or not. The *Start Maximized* and *Dock Position* properties of the window that is being swapped in will be ignored - it will take the dock and maximized state of the window that it is replacing.

This operation is so common in the typical navigation strategy that there is even a version of swapping dedicated to it, the `swapTo` function. This function eliminates the need to specify the window to swap from - you only need to specify the window to swap to. It will take the current "screen" window - that is, the current maximized window - as the window to swap from.

See also:
system.nav.openWindow
system.nav.swapWindow
system.nav.swapTo

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5.7.2.8 Open Windows and Performance

While a window is open, its query bindings are running, its tag bindings are keeping tags subscribed, and its event scripts are being executed. This means that an open window is actively using system resources, both on the Client's host machine, and on the Gateway's server machine as its queries and tag subscriptions must be handled. For these reasons, it is important that you properly implement a navigation strategy that prevents windows that are no longer being used from being held open.

The most common mistake that will cause windows to stay open unintentionally is to implement a swapping navigation system using the `swapTo` function on windows that are not maximized. When you do this, the `swapTo` function cannot calculate the window to swap *from*, thereby simply opening the window, and not closing any windows. It is easy to check the Windows menu to see what windows are currently open. If there are more windows listed there than you can currently see, there is a problem in your navigation logic that is failing to close windows properly.

5.7.2.9 Parameterized Windows

It is often useful to create a *parameterized* window that can be re-used for multiple purposes, depending on the values that were passed into it when it was opened. For example, suppose you have 10 compressors, and the tags that represent them are predictable based upon the compressor number.

```
Compressors/
   C1/
      HOA
      Amps
   C2/
      HOA
      Amps
   ...
   C10
      HOA
      Amps
```

You could make a single compressor status & control screen, and simply pass the relevant compressor number to it when you open it.

Passing Parameters
Any custom property on the root container of a window can be used as a window parameter. Simply specify the names of the custom properties to set in the call to `openWindow` to use them as parameters. Then, use the custom property to create indirect property bindings that bind to the appropriate spot.

For example, let's suppose that you had a window called `CompressorPopup` that you wanted to use to control all 10 compressors. You'd put a custom property on your compressor control window called `compNum`. You would use `compNum` in your tag bindings for the controls on your screen using indirect tag bindings. For example, you might bind the **control** and **indicator** properties of a Multi-State Button to an indirect tag binding like:

```
Compressors/C{1}/HOA
```

where the `{1}` paremeter is bound to the property path:

```
Root Container.compNum
```

You could use a similar indirect binding to display the amperage in an analog Meter component.

Now, when opening the window, you could use a script like this to open it to control compressor #6. Of

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course, you probably wouldn't write this script by hand, you'd use the navigation script builder. But it is useful to know what the script would look like.

```
system.nav.openWindow("CompressorPopup", {"compNum":6})
```

Opening Many Copies
By default, opening a window will only ever open one copy of any given window. If the window is already open, it simply brings it to the front. Normally this is the desired behavior. For example, if you opened the compressor popup window for compressor #6, and then opened it for compressor #4, the window that had been controlling #6 will switch to controlling #4.

Sometimes you may want to open a separate popup, one for #6, and one for #4, both at the same time. If this is the case, use the system.nav.openWindowInstance function call to open your window.

5.7.3 Components

5.7.3.1 Introduction

Components are what fill up your windows with useful content. Anyone familiar with computers should already understand the basic concept of a component - they are the widgets that you deal with every day - buttons, text areas, dropdowns, charts, etc. The Vision module comes with a host of useful components out of the box, many of which are specialized for industrial controls use. Other modules, like the Reporting module, add more components for specialty purposes.

Configuring components will likely be the bulk of a designer's work when designing a Vision project. The basic workflow is to take a component from the palette and drop it into a container on a window. From there, you can use the mouse to drag and resize the component into the correct position. While the component is selected, you can use the Property Editor panel to alter the component's properties, which changes the component's appearance and behavior.

Shapes are components too. Each shape may be individually selected, named, and has its own properties. Shapes have some additional capabilities that other components don't have, such as the ability to be rotated. Shapes are created using the shape tools, not dragged from the component palette.

To make the component do something useful, like display dynamic information or control a device register, you configure property bindings for the component. To make the component react to user interaction, you configure event handlers for it.

5.7.3.2 Creating Shapes and Components

5.7.3.2.1 Component Palette

Choose your palette

There are two styles of component palette in Ignition Vision: the tabbed palette and the collapsible palette. These palettes work in the same way, but the tabbed palette is meant to dock to the north or south edge of the workspace, and one collapsible palette is meant to dock to the east or west edge. By default, the tabbed palette is visible in the window workspace. To switch palettes, navigate to the `View > Panels` menu, and select either the `Tabbed Palette` or the `Collapsible Palette`.

Create a component

There are two primary mechanisms for creating components:
1. Select the component in the palette, and then use the mouse to draw a rectangle in a container.

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While a component is selected in a palette, the mouse curser will be a crosshair (┼) when hovering over a container that the component can be dropped in. Draw a rectangle in the container to specify where the component should be placed and what size it should be.

2. Drag a component's icon from a palette onto a container. The component will be placed where you dropped it at its default size. It can then be resized.

5.7.3.2.2 Shape Tools

Shapes such as lines, rectangles and circles are created using the *shape tools*. By default the shape toolbar appears alongside the right-hand edge of the Designer window, but you can drag it to wherever you prefer. There are a number of tools here for your use, and each one makes the window editing workspace act differently when active.

Shape tools allow you to create various shapes as well as edit them after they are created. Click on the tool's icon to make it the active tool. You can also double-click on a shape to change to that shape's native tool. When a shape tool is active, a toolbar will appear that has specific actions and settings for that tool.

After a shape is created, you can change it's fill color, stroke color, and stroke style. See Fill and Stroke for more. All shapes can be treated as paths and be used with composite geometry functions to alter or create other shapes. See Geometry and Paths for more.

Selection Tool

Normally the selection tool ( ) is active. When this tool is active, you can select shapes and components. Selected components can be moved, resized, and rotated. For more on using the selection tool to manipulate components and shapes, see Manipulating Components.

Rectangle Tool

The rectangle tool ( ) creates and edits rectangle shapes. To create a rectangle, select the tool and drag inside a window to create a new rectangle. Hold down `ctrl` to make it a perfect square. Once a rectangle is created, you can use the square handles to change the rectangle's height and width. This is important because it is the only way to resize a rotated rectangle and let it remain a rectangle. If you resize a non-orthogonally rotated rectangle using the selection tool, it will skew and become a parallelogram, but if you double-click on it so that the rectangle tool is active, you can change the rectangle's width and height using the tool-specific handles.

There are also small circle handles that allow you to alter the rectangle's corner rounding radius. Simply drag the circle down the side of the selected rectangle to make it a rounded rectangle. Hold down control to drag each rounding handle independently if you want non-symmetric corner rounding. You can use the *Make Straight* button in the rectangle tool's toolbar ( ) to return a rounded rectangle to be a standard, straight-corner rectangle.

Ellipse Tool

The ellipse tool ( ) creates and edits circles and ellipses. It is used in much the same way as the rectangle tool. While it is the active tool, you can drag inside a window to create a new ellipse. Hold down `ctrl` to make it a perfect circle. When an ellipse is selected, use the width and height handles to alter the shape.

Polygon / Star Tool

The polygon tool ( ) is used to create polygons and stars. Use the toolbar that becomes visible when

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this tool is active to alter the settings of the shape that is created when you drag to create a polygon. This tool can be used to make any polygon with 3 corners (a triangle) or more. Once created, you can use the center square handle to move the polygon around, and the diamond handles to alter the size and angle of the polygon. Hold down `ctrl` to keep the polygon's rotation an even multiple of 15°.

Arrow Tool

The arrow tool ( ) is used to create single or double-sided arrow shapes. When it is active, simply drag to create a new arrow. Use the checkbox on the toolbar to choose a single or double-sided arrow. To alter the arrow, use the diamond handles to change the two ends of the arrow, and the circle handles to change the size of the shaft and the head. When changing the arrow's direction, you may hold down `ctrl` to snap the arrow to 15° increments.

Pencil Tool

The pencil tool ( ) is used to draw freehand lines and shapes. When this tool is selected, you can draw directly on a window by holding down the mouse button. Release the mouse button to end the path. If you stop drawing inside the small square that is placed at the shape's origin, then you will create a closed path, otherwise you'll create an open path (line).

On the pencil tool's toolbar, there are options for simplification and smoothing, as well as a toggle between creating straight line segments or curved line segments. The simplification parameter is a size in pixels that will be used to decrease the number of points used when creating the line. Points will be in general as far apart as this setting. If you find the line isn't accurate enough, decrease this setting. If you choose to create curved segments, then the segments between points will be Bézier curves instead of straight lines. The smoothing function controls how curvy these segments are allowed to get.

Line Tool

The line tool ( ) can be used to draw lines, arbitrary polygons, or curved paths. Unlike all of the other tools, you don't drag to create new paths with the line tool. Instead, you click for each vertex you'd like to add to your path. To draw a straight line, simply click once where you want the line to start, and double-click where you want the line to end. To make a multi-vertex path, click for each vertex and then double click, press enter, or make a vertex inside the origin box to end the path.

As you draw the line, "locked-in" sections are drawn in green and the next segment is drawn in red. Hold down `ctrl` at any time to snap the next segment to 15° increments.

On the line tool's toolbar, you can choose between three modes: normal line mode, perpendicular mode, and curve mode. Perpendicular mode is just like line mode except that each segment is restricted to either horizontal or vertical. Curve mode will create a Bézier curve path by attempting to draw a smooth curve between the previous two vertices and the new vertex.

Path Tool

All shapes and paths can be edited directly by using the path tool. This tool lets you directly modify the nodes in the path, adding new nodes, removing nodes, and toggling segments between straight or curved. Learn more about paths in the Geometry and Paths section.

Gradient Tool

The gradient tool is used to affect the orientation and extent of any gradient paints. Learn more about gradients in the Fill and Stroke section.

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Eyedropper Tool
The eyedropper tool is used to set the selected shape(s) and/or component(s) foreground/background or stroke/fill colors by pulling the colors from somewhere else in the window. When this tool is active, left-click to set the selection's fill or background, and right-click to set the selection's stroke or foreground. Note that this tool works on most components as well as shapes. For example, right-clicking will set the font color on a Button, or left-clicking will set the background color.

5.7.3.2.3 Custom Palettes

Custom palettes are like expanded copy/paste clipboards. They allow you to put customized components or groups of components into a palette for quick access.

To create a custom palette, right click on a tab in the tabbed palette or a header in the collapsible palette, and choose *New Custom Palette*. Your custom palette will appear as the last palette. Your custom palette has one special button in it, the capture button ( ). To add components to your palette, select them and press the capture button. This effectively does a copy, and stores the captured components as a new item in the clipboard. You can then use that item much like a normal component, and add multiple copies of it to your windows.

Note that these are simple copies, and are not linked back to the custom palette. Re-capturing that palette item will not update all uses of that item across your windows.

5.7.3.2.4 SQLTags Drag-n-Drop

Components can also be created by simply dragging a SQLTag onto a container. Depending on the datatype of the tag, you will get a popup menu prompting you to select an appropriate type of component to display or control that tag.

For example, suppose you have an Int4 type tag, If you drag the tag from the SQLTags Browser panel onto a component, you will be prompted either to display or control the tag with a variety of labels, level indicators, numeric entry fields, and control buttons.

This technique is great for beginners and for rapid application design. By dropping a SQLTag into a container and choosing a component type, a few steps are happening:

The component that you chose is created at the position you dropped it.
A variety of property bindings are created automatically. The bindings depend on what kind of tag was dropped and what kind of component was created. For example, lets suppose you have a `Float8` point that represents a setpoint, and you want to set it. Drop the tag onto a container and choose to control it with a *Numeric Text Field*. The following bindings will be set up automatically
- The text field's `doubleValue` property gets a *bidirectional* tag binding to the tag's `Value` property.
- The text field's `minimum` and `maximum` properties get tag bindings to the tag's `EngLow` and `EngHigh` properties, respectively.
- The text field's `decimalFormat` property gets a tag binding to the tag's `FormatString` property.
- The text field's `toolTipText` property gets a tag binding to the tag's `Tooltip` property

It is important to realize that multiple property bindings are created when creating components this way. These bindings not only use the tag's value, but much of the tag's *metadata* as well. Using the tags metadata in this way can greatly improve a project's maintainability. For example, if you decide that the setpoint needs 3 decimal places of precision, you can simply alter the tag's `FormatString` to be `#, ##0.000`, and anywhere you used that tag will start displaying the correct precision because of the metadata bindings.

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See also:
Property Binding Overview
SQLTag Metadata Properties

5.7.3.3 Selecting Components

There are a number of different ways to select components within a window, each of which have their own advantages.

Mouse Selection

Using the mouse is the most common way to select components. Make sure that the selection tool ( ) is the active tool. Simply click on a component to select it. If the component you want to select is obscured by other components, hold down `alt` and keep clicking, the selection will step down through the z-order.

You can also select components using *window-selection*. Click-and-drag in a container to draw a selection rectangle. If you drag the window left-to-right, it will select all components that are contained within the rectangle. If you drag the window right-to-left, it uses *window-crossing selection*. This will select all components that are contained within the rectangle or intersect the edge of the rectangle. Lastly, you can start dragging a window selection and then hold down the `alt` key to use *touch-selection*. This will draw a line as you drag, and any components that the line touches will become selected. As you're using these techniques, components that are about to become selected will be given a yellow highlight border.

Tree Selection

By selecting nodes in the project browser tree you can manipulate the current selection. This is a handy way to select the current window itself, which is hard to click on since it is behind the root container. (you can click to it though, using alt-click to step down through the z-order). It is also the only way to select components that are invisible.

5.7.3.4 Manipulating Components

Manipulating components can be done with both the mouse and the keyboard. To manipulate a component or group of components, you'll first need to select them.

Resizing

Once the components you want to alter are selected, they'll gets 8 *resize-handles* displayed around the edge of the selection. These handles look like double-sided arrows around the perimeter. Use the mouse to drag them to change the size of the components in the selection. To maintain the selection's aspect ratio, hold down `ctrl` as you resize. To resize around the center of the current selection, hold down `shift`.

You can also resize the current selection using the keyboard. To nudge the right or bottom edge of the selection in or out, use `shift` combined with the arrow keys. To nudge the top or left edge of the selection, use `ctrl-shift` combined with arrow keys. These nudge actions will resize one pixel at a time. To resize faster, add the `alt` key.

Moving

To move the component, simply drag it anywhere within the component's bounds. You can also move

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whatever is currently selected by holding down `alt` while dragging, regardless of whether or not the mouse is over the current selection. This is important because it is the primary way to move a Container component. (Normally, dragging in a container draws a selection rectangle inside that container).

While a component is selected, you may also use the keyboard's arrow keys to move a component around. The arrow keys will move the selection one pixel at a time. Just like resizing with the arrow keys, to move faster, add the `alt` key.

Components can be easily duplicated by dragging them as if you were going to move them and holding down the `ctrl` key. This will drop a copy of the component at the desired drop location. It is often useful to also hold down `shift` as you do this to ensure exact alignment. You may also use the `ctrl-D` shortcut to quickly duplicate a component in place.

Rotating

Shapes can be rotated directly using the selection tool. Other components cannot be rotated in this manner. To rotate a shape, first select it using the selection tool so that you see the resize handles around it. Then simple click on it once again and you'll see the rotation handles appear. Clicking (but not *double-clicking*) on selected shapes toggles back and forth between the resize handles and the rotation handles.

Once you see the rotation handles, simply start dragging one to rotate the shape or shapes. Holding down the `ctrl` key will snap your rotation movements to 15° increments. When the rotation handles are present, there is also a small crosshair handle that starts in the middle of the selection. This is the *rotation anchor*: the point that the selection will rotate around. You can drag it anywhere you'd like to rotate around a point other than the center of the shape.

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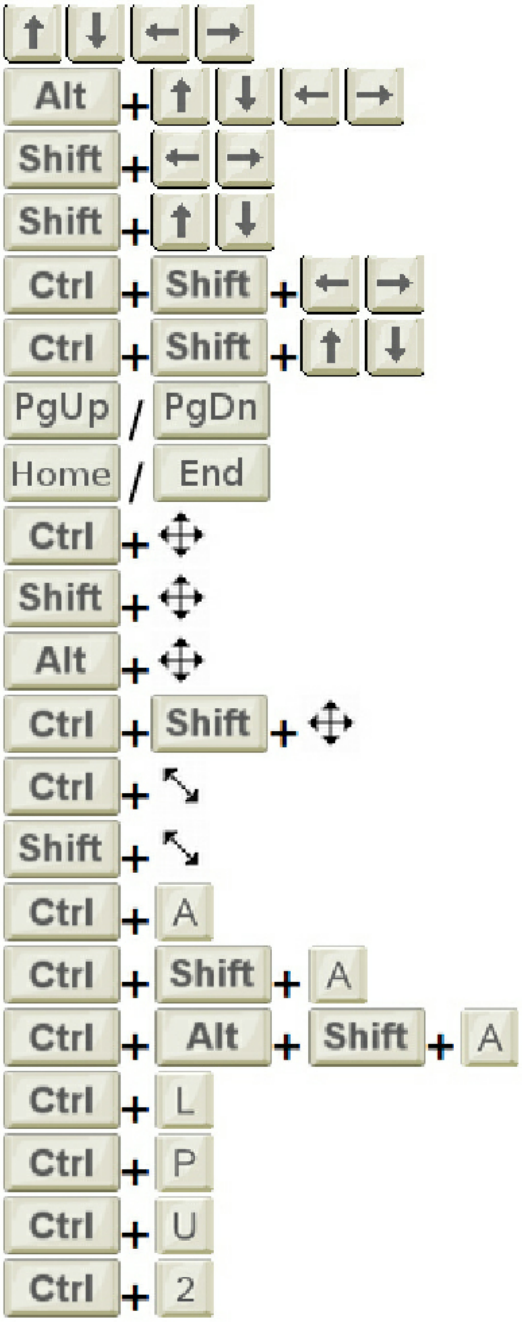
5.7.3.5 Keyboard Shortcuts



Nudge. Move selected component(s) the direction of the arrow key by the default nudge distance.

Alt-Nudge. Just like nudge, but uses the "alt-nudge" distance.

Resize Right. Moves the right edge of the component left or right. Add Alt to use the alt-nudge distance.

Resize Bottom

Resize Left

Resize Top

Move Forward / Move Backward. Move selected component(s) in the Z-order

Move to Front / Move to Back

Copy-Move. Holding ctrl while doing a mouse-move copies the component.

Orthogonal-Move. Holding shift while doing a mouse move restricts to only moving straight up, down, left or right.

Selection-Move. Holding alt while dragging will drag the current selection.

Copy-Axis-Move. Combines copy move with axis move.

Proportional Resize. Resizes a component while maintaining its aspect ratio.

On-Center Resize. Resizes the selection using the center as the anchor point.

Select All. Selects all components that are siblings of the selected component.

Select Same Type. Selects all components that are siblings of the selected component and the same component type.

Select Same Type in Window. Selects all components in a window that are the same type as the selected component.

Layout. Edit component(s) layout.

Size & Position. Exact size and position for selected component or window.

Customizer. Opens Customizer to configure complex component properties.

Customizer 2. Opens the second Customizer if available.

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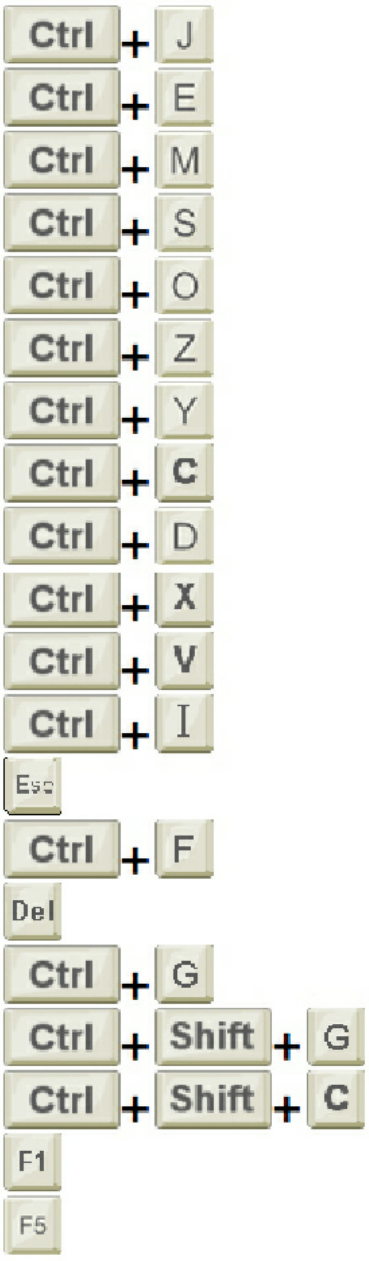

Jython. Configure Actions for component or window.

Security. Configures secuirty for Component(s) or window.

Script Modules. Opens Script Module window for reuseable Jython functions.

Save. Saves project.

Open. Opens a different project.

Undo. Undo last action.

Redo. Redo Gets rid of the last undo action.

Copy. Copy Selected Component(s) or Window.

Duplicate. Duplicate Selected Component(s) or Window.

Cut. Cut Selected Component(s) or Window.

Paste. Paste Components(s) or Window in Clipboard. Pasted component(s) wait for position before pasting.

Immediately Paste. Pasted component(s) are placed at the same location where they were copied/cut.

Cancel Paste. Cancels a pending paste operation.

Find / Replace. Searches and replaces the project based on string, pattern, or regex.

Delete. Deletes the current selection.

Snap to Grid. Toggles whether or not moving and resizing components snaps to the grid.

Snap to Guides. Toggles whether or not moving and resizing components snaps to guides.

Console. Opens the output console.

Help. Launch the user manual in a web browser.

Preview Mode. Toggles preview / design mode.

5.7.3.6 Properties

Each component has a unique set of *properties*. A property is simply a named variable that affects something about the component's behavior or appearance. Each property has a distinct type. Hover your mouse over the property in the Property Editor panel to see its data type and scripting name.

5.7.3.7 The Property Editor

The property editor is a dockable panel that appears in the window workspace, usually under the SQLTags Browser panel. It displays the properties of the selected component. If more than one component is selected, then it will show all properties that the current selection set have in common.

Filters

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It is common for components to have many properties, so the property editor by default only shows the *basic* properties. These are the properties that you'll most commonly want to set or bind for a given component. There is also the *standard* properties. This is a larger set of properties that includes the basic properties and many other useful properties. Some properties are *expert* properties. These are properties that are either uncommon to set or whose purpose might require an in-depth understanding of the inner-workings of the component. You can change the filter using the filter button ( ) in the property editor's toolbar.

Status Indication

The name of a property in the property editor conveys important information about that property:

A blue name indicates that the property is a custom property.

A **bold name** with a link icon indicates that the property is bound using a property binding.

A **bold name** with a color palette icon indicates that the property is being affected by the component's styles settings.

A **red bold name** with a warning icon indicates that the property is double-bound. This means that two things, a property binding and the styles settings are both trying to drive the property value. This is almost assuredly a mistake.

The Binding Button

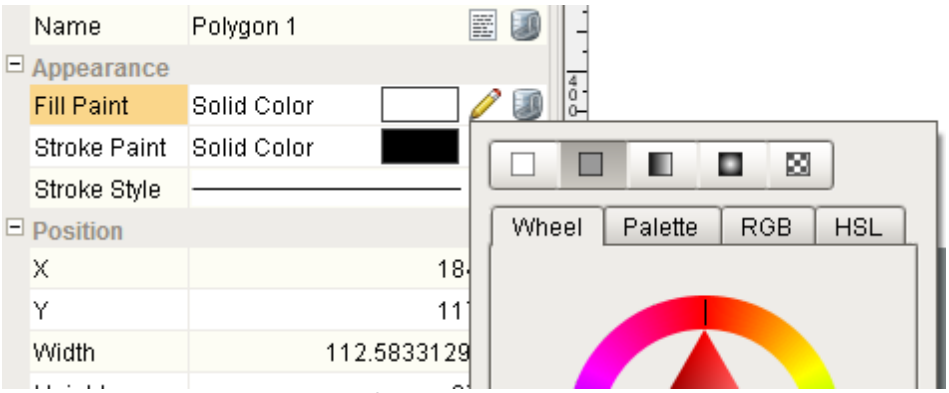
To the right of most properties is the binding button ( ). Use this button to modify the property binding that is driving that property. You can only use this button when the window workspace is not in preview mode. Some properties cannot be bound because their datatype is not supported by the binding system. You can still use scripting to affect these properties.

5.7.3.8 Fill and Stroke

All shapes have three properties that affect how they look. The *Fill Paint* is a property of type `Paint` that represents the interior color of the shape. The *Stroke Paint* property (also a `Paint`) represents the color of the shape's outline. The *Stoke Style* property is a property of type `Stroke` that affects the thickness, corners, and dash properties of the shape's outline.

Editing Paints

Both the fill and stroke paints can be a variety of different kinds of paints. To edit a shape's fill or stroke paint, you can either use the paint dropdown in the property editor table by clicking on the pencil icon ( ) or open up the dedicated Fill and Stroke panel from the View menu.



Editing a shape's fill paint using the dropdown editor.

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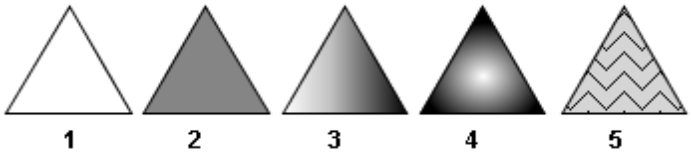
Paint Types

The top of the paint editor is a selection area that allows you to choose between the five different kinds of paints.

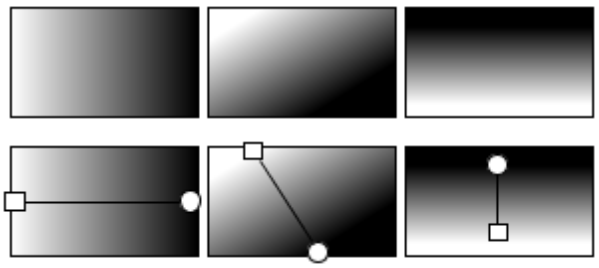


The five different paint types demonstrated as triangle fill paints.

1. The first paint type is *no paint* ( ). If used as a fill paint, then the interior of the shape will be transparent. If used as the stroke paint, then the paint's outline will not be drawn at.
2. The second paint type is a *solid color* ( ). This paint type is equivalent to the `Color` type used elsewhere throughout the component library. A solid color is any color, including an alpha (transparency) level.
3. The third paint type is a *linear gradient* ( ). Linear gradients smoothly blend any number of colors along a straight line across the shape. Each color is called a *Stop*. Each stop is represented as a drag-able control on a horizontal preview of the gradient in the gradient editor. You can click on a stop to select it and change its color or drag it to reposition it. You can right click on it to remove it. You can right click on the preview strip to add new stops and change the gradient's cycle mode.
4. The fourth paint type is the *radial gradient* ( ). Radial paints are very much like linear paints except that the colors emanate from a point creating an ellipse of each hue. Radial paints are configured in the same way as linear paints.
5. The fifth paint type is the *pattern paint* ( ). This paint uses a repeating pixel-pattern with two different colors. You can pick a pattern from the dropdown or create your own using the built-in pattern editor.

Gradient Paint Bounds

The two gradient paints are more than a list of colored stops; they also need to be placed relative to the shape. The same gradient may look wildly different depending on how it is placed against the shape. By default, a linear gradient will run horizontally across the width of the entire shape, but this is readily changed. By switching to the Gradient Tool ( ), you can drag around handles that control how the gradient is applied.



The same gradient, applied differently to the same shape.

Gradient Cycles

The two gradient paints (linear and radial) both have a cycle mode that you can change by right-clicking within the preview strip. The cycle modes are illustrated below:

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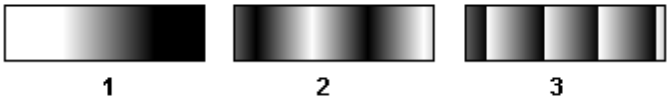


1. *No Cycle*. The first and last stops are repeated forever after the edge of the paint bounds.
2. *Reflect*. Beyond the bounds of the paint, it will be reflected and drawn in reverse, and then reflected again, creating a smooth repetition.
3. *Repeat*. Beyond the bounds of the paint, it will be repeated forever.

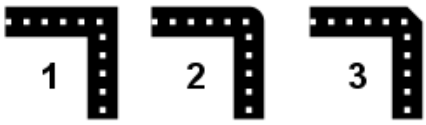
Stroke Style

A shape's stroke paint is only half the story. The stroke style is also an important component of how an outline is drawn. Primarily the style controls the *thickness* of the line drawn, but it also can be used to create a *dashed line*. The setting for thickness is specified in pixels, and creating a dashed line is as easy as picking the style from the list.

The effect the thickness and dash pattern settings is fairly self-explanatory, but the other stroke settings are a bit more subtle. You can notice their effect more readily on thick lines.

Cap styles

Cap style is a setting that controls what happens at the end of a line segment. You can either have the line simply be terminated with no decoration (#1), Round off the end with a semi-circle (#2), or cap the end with a square (#3).



Join styles

Join style is a setting that affects how a line is drawn where two segments meet (a corner). The default setting is called a miter join (#1), where the stroke is extended into a point to make a sharp corner. The other options are rounded corners (#2) or beveled edge corners (#3).

Miter length illustrated

Miter style joins can become a problem for very sharp angles. With a sufficiently sharp angle, the miter decoration can become extremely long. To control this, there is a miter length setting to limit the length of a miter decoration. The illustration on the left shows the same miter join with two different miter length settings. The first drawing illustrates the length of the miter join.

5.7.3.9 Geometry and Paths

All of the basic shapes, as well as anything created with the pencil or line tool, can be considered to be a *path*. A path is a series of points and segments between those points. Any two points can either be disconnected (no line between them), connected with a straight line segment, or connected with a Bézier curve.

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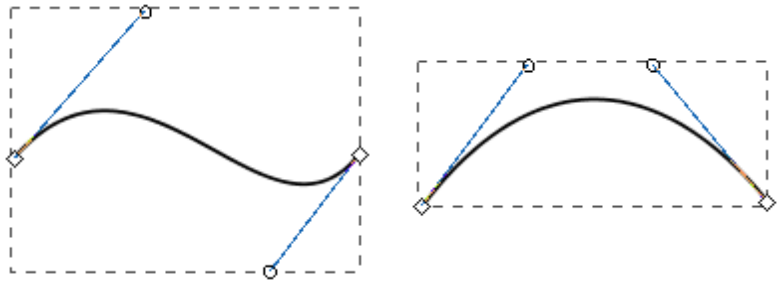
Bézier Curves

A Bézier curve, also sometimes called a quadratic curve, is a type of curve used in vector graphics that connects two points. A Bézier curve is configured using four points: the two end-points and two control points. The curve starts along the line between the an endpoint and the first control point, and then curves to smoothly meet the line between the second control point and the other endpoint.



Examples of Bézier curves

Editing Paths Directly

Editing paths is done using the path tool ( ). Simply select any shape or line while the path tool is active to start editing it. If the shape is already a path, you can also switch to the path tool by double-clicking on the shape. You can convert any shape into a general path by selecting the *To Path ( )* function under the *Shape* menu. Shapes will also implicitly be turned into paths if they are altered in a way not supported by the underlying shape. For example, if you stretch a rotated rectangle, thereby skewing it into a parallelogram, it will become a path automatically.

Each point on the path is represented by a diamond-shaped handle when the path editor is active. These handles can be dragged to move them around. They can also be selected by clicking on them or dragging a selection rectangle to select multiple points. This allows groups of points to be altered simultaneously. Bézier segments also have handles on their control points, represented by small circles with a line drawn back to an endpoint that can be dragged to change the curvature of the segment.

To change a segment between open, straight, and curved, simply use the toolbar functions that become visible when the path editor tool is active. Points can also be added and removed using the functions on the path editor toolbar. Filled shapes have two fill settings that control whether or not holes in the shape should be filled. To remove the fill entirely, simply set the fill paint property to "No Paint".

Tip! When editing paths directly, it is often useful to be zoomed in on the path. Don't forget that you can zoom in on a location by holding down `ctrl` and using your mouse wheel to zoom in on a particular area without having to zoom in and then scroll. Also, if you press your mouse wheel in, you can pan around your window.

Creating and Editing Shapes Using Constructive Area Geometry

Editing paths directly can be a bit awkward. Using Constrictive Area Geometry is usually a much easier and more intuitive to get the shape that you want. These functions are accessed from the *Shape* menu and operate when two (or more) shapes are selected. Note that the order that you select the shapes is important for many of these functions. Typically, the first shape you select is the shape you want to retain, and the second shape is the shape that you want to use as an "operator" on that first shape.

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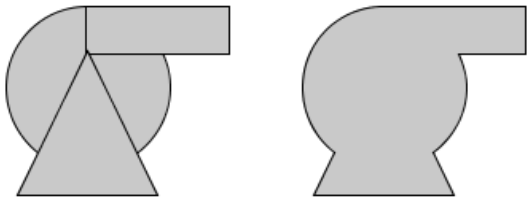
Union

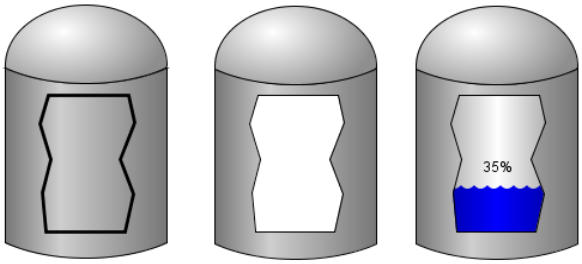
The union function combines two or more paths into one. The resulting shape will cover the area that any of the shapes covered initially. The example shows how the union of a circle, rectangle, and triangle can be unioned together to create a basic pump symbol. Creating the symbol using this method took a few seconds, whereas attempting to draw this shape by hand using paths would be quite frustrating.



Union: combine basic shapes to make symbols

Difference

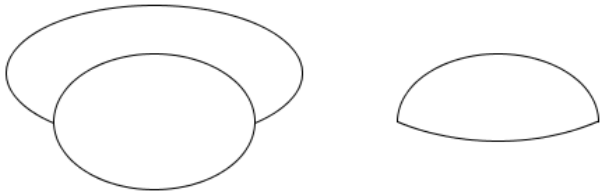
The difference function can be thought of as using one shape as a "hole-punch" to remove a section of another shape. The example shows how a zigzag shape drawn with the line tool can be used to punch a cutaway out of a basic tank shape. The level indicator is added behind the resulting shape to show how the area where the zigzag shape was is no longer part of the tank shape.



Difference: create cutaways and holes in shapes.

Intersection

The result of an intersection function will be the area only where where two shapes overlap. The example shows how the "top" of the tank in the difference example was easily made using two ellipses.



Intersection: where two shapes overlap

Exclusion

The exclusion function, sometimes called X-OR, creates a shape that occupies the area covered by exactly one of the source shapes, but not both.

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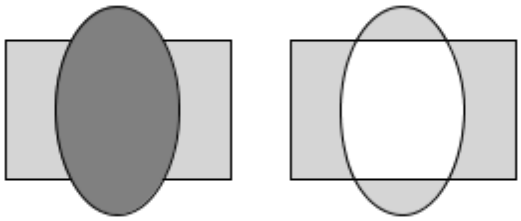
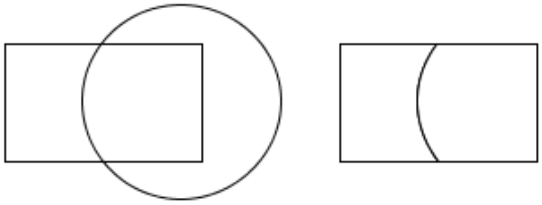


Exclusion: XOR for shapes!

Division
The division function divides or cuts one shape up along the outline of another shape.



Division: cut up a shape using the outline of another.

5.7.3.10 Data Types

There is a wide variety of datatypes across all of the Vision Module's components. Here are the most common types that you'll find.

Numeric Types

`Boolean`	A `true`/`false` value. Modeled as `0`/`1` in Python. Technically, `0` is `false` and anything else is `true`.
`Short`	A 16-bit signed integer. Can hold values between -2^{15} and $2^{15}-1$. Thats -32,768 to 32,767, inclusive
`Integer / int`	A 32-bit signed integer. Can hold values between -2^{31} and $2^{31}-1$. Thats -2,147,483,648 to 2,147,483,647 inclusive
`Long`	A 64-bit signed integer. Can hold values between -2^{63} and $2^{63}-1$. Thats -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807 inclusive
`Float`	A 32-bit signed floating point number in IEEE 754 format.
`Double`	A 64-bit signed floating point number in IEEE 754 format.

Non-Numeric Types

`String`	A string of characters. Uses UTF-16 format internally to represent the characters.
`Color`	A color, in the RGBA color space. Colors can easily be made dynamic or animated using Property Bindings or Styles
`Date`	Represents a point it time with millisecond precision. Internally stored as the number of milliseconds that have passed since the "*epoch*", Jan 1st 1970, 00:00:00 UTC.
`Dataset`	A complex datastructure that closely mimics the structure of a database table. A Dataset is a two-dimensional matrix (a.k.a. a table) of data organized in columns and rows. Each column has a name and a datatype.
`Font`	A typeface. Each typeface has a name, size, and style.
`Border`	A component border is a visual decoration around the component's edges. You can make a border dynamic by using Styles or the toBorder expression.

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Whats the difference: `Integer` *vs* `int`**?** The difference is that an `Integer` property will accept the special `null` (or `None` in Python-speak) value, while an `int` property will not. This distinction holds true for all of the numeric types: the type name that starts with a capital letter accepts null, while the all-lowercase version does not.

Expert Tip: Most of these datatypes are actually defined by Java. For example, the Date datatype is really an instance of a `java.util.Date`. This means that you can use the `java.util.Calendar` class to manipulate them, and the `java.text.SimpleDateFormat` class to format and parse them. Learn more about these classes in the Java 2 Platform online documentation at http://java.sun.com/j2se/1.5.0/docs/api/index.html

See also:
Working with Different Datatypes

5.7.3.11 Component Customizers

In addition to their properties, many components can be further customized using a *Customizer*. Many components will have more than one customizer. You can open the customizer for any component by right-clicking on it and choosing the `Customizers` menu, or by using the customizer split-button ( ) in the Vision main toolbar.

Customizers are used to configure components in ways that are too complex or cumbersome for basic properties. Some customizers are used repeatedly for many different components, for example, the "Custom Properties" customizer and the "Styles" customizer. Other customizers are unique for their component, for example the "Easy Chart" cutsomizer or the "Report Designer" customizer.

Expert Tip: Often, a customizer is really just a user-friendly user interface to one or more expert properties. For example, all the Easy Chart customizer really does is modify the contents of the *pens, tagPens, calcPens, axes,* and *subplots* Dataset properties. Knowing this is very powerful, because this means you can also use Property Bindings and scripting to modify the values of these expert properties *at runtime*, giving you the ability to dynamically perform complex manipulations of components.

5.7.3.12 Custom Properties

Most Vision components support *custom properties*. This means that in addition to the normal properties of the component, you can add your own properties. You can think of these properties like your own variables in the window.

How to use Custom Properties

Custom properties are extremely useful and are integral to creating maintainable projects using Ignition Vision. They let you turn a "plain" component into one customized for your particular use.

To add a custom property, open up the *Custom Property Customizer* on a component that supports it. This is a simple customizer that lets you edit a table of the custom properties for the component. When you hit OK, you'll notice the custom properties you added displayed in the Property Editor in blue. You can use these properties like any others - with data binding, scripting, styles, etc.

Example
Let's look at an example that will use the custom properties and the Styles feature together. Take the lowly Label component. It seems pretty plain at first - it just displays a String. Of course, you can use its foreground color, background color, and border to make it look interesting. Put an integer custom property on it called `state`, and bind that property to a discrete state tag coming out of a PLC. Now use the `state` to drive its Styles configuration to make the component look different and display different

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things based on the state being 0, 1, or 2 (maybe for a Hand/Off/Auto indicator) Now, we could have used the Multi-State Indicator from the get-go, but understanding this example will let you create your own types of components by combining the existing components in creative ways.

Root Container Custom Properties

Properties on the window's Root Container are special in that they double as a window's *parameters*. See Parameterized Windows for more.

5.7.3.13 Component Styles

Many components support the Styles feature. This is a feature that allows you to define a set of visual styles that will change based upon a single *driving* property. Typically, you'll have a property (often a custom property) on your component that you want to use as a driving property, usually a discrete state, and you have multiple visual properties, like the font, border, foreground color, visibility, etc that you want to change based upon that one driving property.

Styles lets you define these relationships all at once, and with a preview to boot! Configuring styles goes like this:
1. Pick a *driving property.* This is the property whose value will determine the current style.
2. Pick one or more *styled properties*. These are the properties that will change as the style changes.
3. Add the values of the *driving property* that define the styles (e.g. 0=off, 1=hand, 2=auto)
4. Customize the values of the *styled properties* for each style.

Example
Lets say that you have a Level Indicator component that is displaying the level in a tank. Lets say that you want to have its appearance change based upon the alarm state of the tank's temperature. You can add an integer custom property to the level indicator that you'll bind to the tank temperature tag's `AlertCurrentSeverity` property.

Now go into the Style customizer. Choose your severity property as the driving property, and the Border and Filled Color properties as the styled properties. Add states for -1 (not in alarm), 2 (Medium alarm) and 4 (High alarm). Leave the -1 state alone. Use a red border for state 2 and an orange fill color. For state 4, you can animate it to get a flashing effect. Add two animation frames and set their delay to 500ms each. Configure the frames differently from each other so that you can get a flashing effect.

Hit OK - thats it! Notice that the styled properties that you chose are now bold and have the styles indicator ( ) next to them. This is to help remind you that those properties are being driven, so if you change their values directly, you changes will be overwritten.

5.7.3.14 Quality Overlays

Sometimes things don't go quite as expected. Connections get broken, switches die, machines crash. Aside from taking reasonable steps to prevent these occurrences, it is especially important in HMIs to be able to gauge the health and accuracy of what is displayed at a glance. In a highly distributed system like Ignition, it is especially important, as the client may be located at quite a distance (maybe across the world) from the physical process it is monitoring and controlling.

For these reasons, components will get visual overlays for various reasons to indicate that the data they are displaying is not good. Each data binding that drives a component is evaluated for quality. If any of these qualities becomes poor, the component will show an overlay. The different overlays can mean different things, denoting their underlying cause. These follow the Quality properties of SQLTags.

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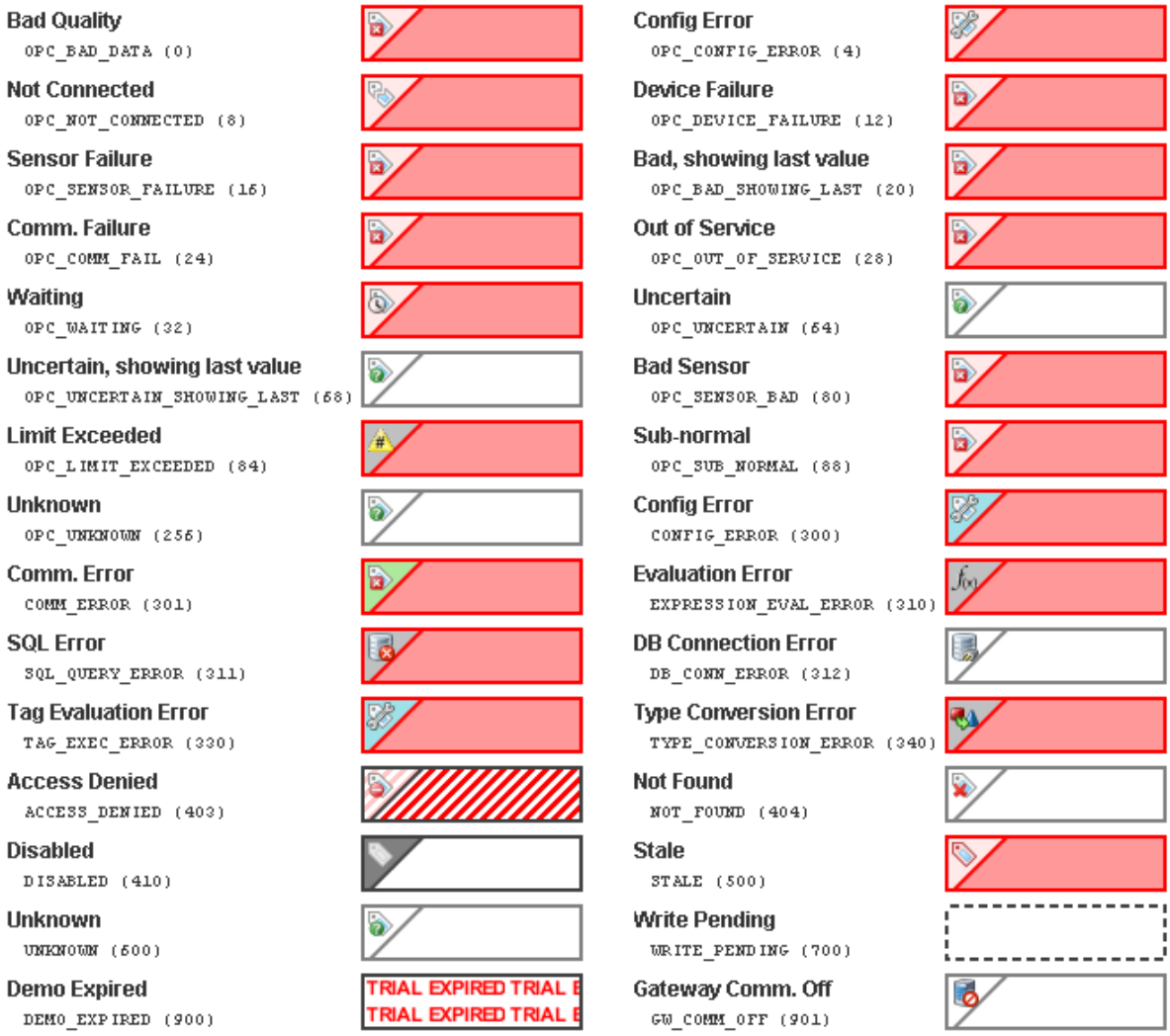

5.7.3.15 Touchscreen Support

It is very common to deploy Ignition Vision projects on touchscreen computers. Often, these are industrial panel-pcs acting as HMI or OIT terminals. Normally touchscreens simply act like a mouse input device. However, these touchscreens usually don't have a keyboard attached. For this reason, all of the input components in Vision are touchscreen-enabled.

Under normal circumstances, you don't have to do anything special other than enable touchscreen-mode on your project. This will allow the operator to enable touchscreen mode when they log in. You can also enable touchscreen mode via scripting.

Touchscreen-enabled input components all have an expert level property called `Touchscreen Mode`. Normally, this is set to *Single-Click*, meaning that the touchscreen keyboard or numeric keypad (depending on the type of input component) will appear on a single click in that component. You can also change this to *Double-Click*, which should be self-explanatory, or *None*. None means that automatic touchscreen support is disabled for this component. You may want to set this to handle touchscreen logic via scripting.

To handle touchscreen logic via scripting, the general pattern is to respond to a mouse event, popup up

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a keyboard, and then set the component's value to whatever was entered in the keyboard. For example, for a text field, you would write a script like this:

```
if system.gui.isTouchscreenModeEnabled():
   currentText = event.source.text
   newText = system.gui.showTouchscreenKeyboard(currentText)
```

See also:
Client General Properties
system.gui.setTouchscreenModeEnabled

5.7.3.16 Component Layout

Layout is the concept that a component's size and position relative to its parent container's size and position can be dynamic. This allows the creation of windows that resize gracefully. This is a very important concept because of the web-launched deployment of Vision clients - they often end up being launched on many different monitors with many different resolutions.

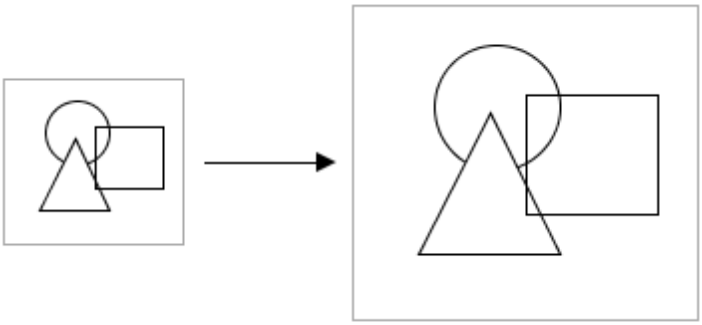
This is also important for components that have user-adjustable windows like popup windows. Imagine a popup window that is mostly displaying a large table or chart. If you're running on a large monitor, you may want to make the window bigger to see the table or chart easier. Of course, this is only useful if the table or chart actually gets larger with the window.

Changing a component's layout is as simple as right-clicking on the component and opening the Layout dialog box. You can also alter the default layout mode that gets assigned to new components. See Designer Window Editing Properties.

Relative vs Anchored Layout

There are two layout modes, and they are set on a per-component basis. Both affect the component's size and position relative to its parent container. The root container's size is dictated by the window size.

Relative Layout
Relative layout is the default mode. This is a simple but effective layout mode that simply keeps a component's size and position relative to its parent container constant, even as the parent container grows or shrinks. More precisely, it remembers the component's position and size as a percentage of its parent's bounds at the last time the window was saved. Relative layout also has the option of scaling a component's font appropriately.



Example of Relative Layout

Note that relative layout mode respects aspect ratio. So if the parent component is distorted, the contents will not be. The extra space is distributed evenly on both sides of the contents.

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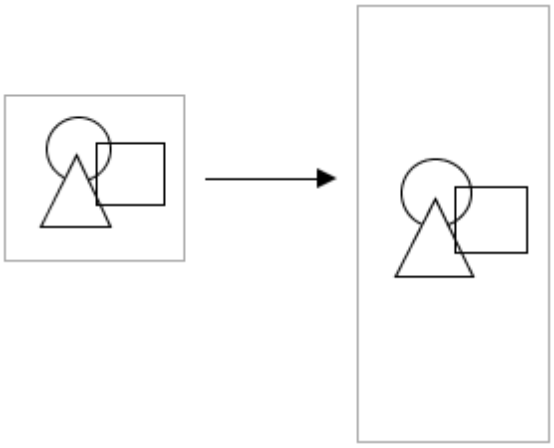
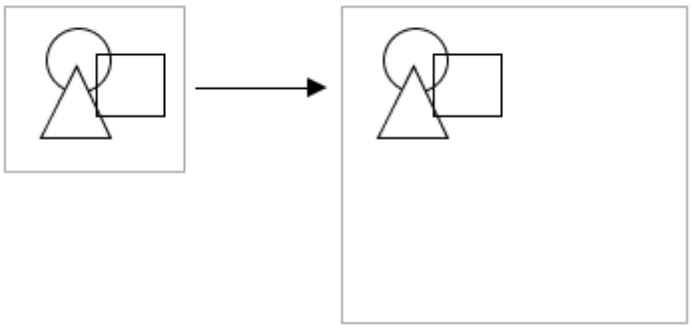


Relative layout preserves aspect ratio

Anchored Layout
Anchored layout lets you specify various "anchors" for the component. The anchors dictate how far each of the 4 edges of the component stay from their corresponding edges in the parent container. For example, if you anchor top and left, then your component will stay a constant distance from top and left edges of its parent. Since you didn't specify an anchor for the right or bottom sides, they won't be affected by the layout.



Components anchored top and left

If you anchor bottom and right instead, the components will again stay the same size (since you didn't specify an anchor for their other edges, but they will stay a constant distance from their parent's right and bottom edges.

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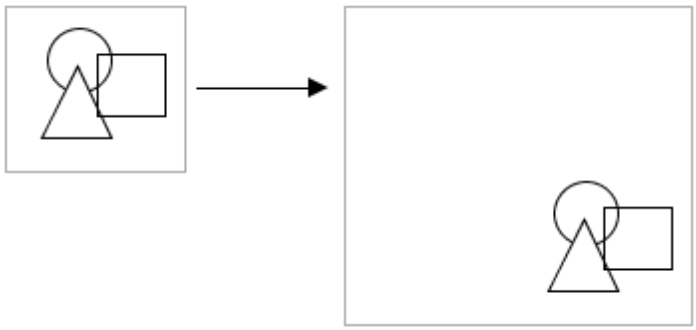
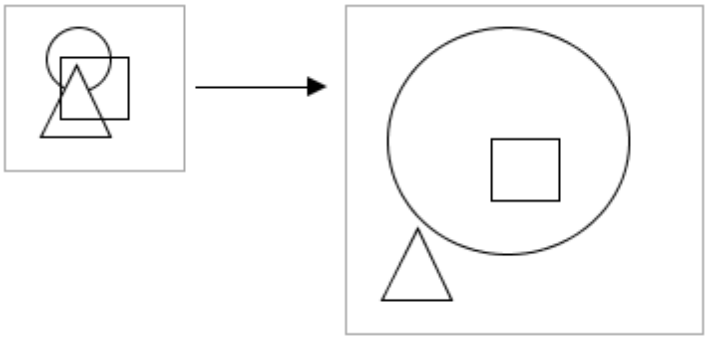


Components anchored bottom and right

Of course, you can mix and match the various modes. There are also special centering anchors. The following image shows the following:

The square uses a horizontal and vertical centering anchor. It is centered, and stays the same size.
The triangle is anchored bottom and west.
The circle is anchored top, left, bottom, and west. This means that its edges are all anchored and stay a fixed distance to each of its parent's edges, so it grows.



Components with various anchoring modes

Client Minimum Size

Clients can define a minimum size, because even with dynamic layout, you usually don't want the client to get too small. This is because it would become unusable and unreadable. This is what the Minimum Size property is for. By default it is set to 800x600, but you can adjust it. See Client User Interface Properties.

5.7.3.17 Shape Components

All of the shapes that you can draw using the shape tools are themselves components. As such, they have properties, event handlers, names, layout constraints, and all of the other things that you'll find on other components. They also have some things that normal components don't.

Binding Shape Position

One such thing that shapes have that normal components don't is a set of properties that control their location. These properties are called `relX`, `relY`, `relHeight`, and `relWidth`. The "rel" prefix stands for "relative". This comes from the fact that the values of these properties are always treated as relative

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to the shape's parent container's width and height, even in a running client where that container may be a wildly different size due to the layout mechanism.

For example, let's say that you have a shape that is located at x=100, y=100, and was 125 by 125 inside a container that is 500 by 500. If you want to animate that shape so that it moves back and forth across the screen, you'd set up a binding so that `relX` changed from 0 to 375. (You want X to max out at 375 so that the right-edge of the 125px wide shape aligns with the right edge of the 500px container).

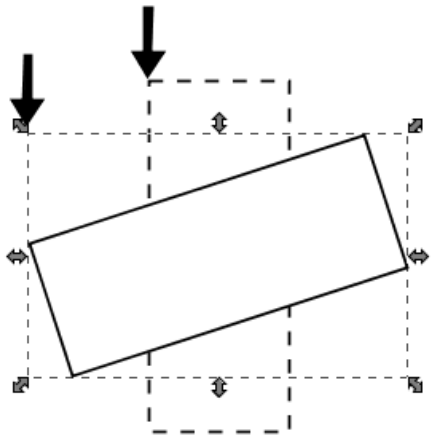
Now, at runtime, that container might be 1000 by 1000 on a user's large monitor. By binding `relX` to go between 0 and 375, the true X value of your shape (whose width will now be 250px due to the relative layout system), will correctly move between 0 and 1750, giving you the same effect that you planned for in the designer.

Long story short, using the `rel*` properties let you animate the shape using bindings and not worry about the details of the layout system and how they'll resize the coordinates at runtime.

Binding Rotation

Another ability unique to shapes is the ability to be rotated. Simply click on a selected shape and the resize controls become rotate controls. There's even a rotation property that can be edited directly or bound to something dynamic like a tag.

⚠ Binding the rotation comes with one **big warning**, however. Observe that when you change a shape's rotation, it's position also changes. (The position of any shape is the top-leftmost corner of the rectangle that completely encloses the shape)



Rotating the shape dramatically changes it's position

Because of this effect, if you wish to both dynamically rotate *and* move a component, special care must be taken since rotation alters the position. You don't want your position binding and the rotation binding both fighting over the position of the component. The technique to both rotate and move a shape is as follows:

1. Bind the rotation on your shape as you wish.
2. Create a shape (e.g. a rectangle) that *completely encloses* (in other words, it's bigger than) your shape at *any rotation angle*.
3. Set that rectangle's visible property to `false`.
4. Select your shape and the rectangle and group them.

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5. Bind the position on the resulting group.

If you follow these steps you can animate both the rotation and position of a shape.

5.7.3.18 Grouping

Shapes and components can be grouped together so that they act like a single component in the Designer. Grouping components is very similar to putting them in a Container. In fact, it is the same thing as cutting and pasting them into a perfectly-sized container and then putting that container into group mode, with one exception. If the group contains only shapes and no other kinds of components, it will be a special shape-group that has the ability to be rotated and has some other shape-like properties.

When components or shapes are in a group, clicking on them in the Designer will select the group instead of the shape. If you double-click on a group, it will become "super-selected", which will allow you to interact with its contents until you select something outside of that group.

Layout also works differently for groups. The layout setting for components and shapes inside a group is ignored. All members of a group act as if they are in relative layout with no aspect ratio restrictions. This special group-layout mode is also active when resizing a group inside of the Designer, whereas traditional layout doesn't take effect in the Designer.

Groups can contain other groups, creating a nested structure. Groups themselves are also components, meaning that you can add custom properties to groups, bind them, etc.

5.7.3.19 Using Symbol Factory

If you have the Symbol Factory module installed, you've got nearly 4,000 industrial symbols at your fingertips. The first step to using the Symbol Factory is to open up the Symbol Factory browser. To do this first launch a Designer. Once the Designer has your project open, choose Symbol Factory under the Tools menu or the project navigation tree. If you can't find these, the Symbol Factory module probably isn't installed.

The Symbol Factory browser opens as a pop-up window that stays on top of the Designer. You can browse the different categories to explore what symbols are available, or search to find a specific symbol. When you find a symbol that you'd like to use, you can simply drag it onto an open Vision window. From there, the symbol will become a group of shapes. Just like any group, you can double-click on it to get to the shapes inside, or simply un-group it. This way you can edit the symbol if you need to. **Note:** If the Symbol Factory module is in trial mode, you'll only be able to use the first symbol from each category.

Symbol Factory Tip #1: Animating the Tint on a Grayscale Symbol

Suppose you have chosen one of the many grayscale symbols, such as the "`3-D Valve`" symbol from the `Valves` category. Let's say you want to tint the valve green when the valve is open, red when the valve has a fault, and keep it gray when the valve is closed. Suppose you have a tag, let's call it `ValveStatus`, that is 0 for closed, 1 for open, and 2 for faulted. Follow these steps to tint the symbol as described above:

1. **Drag** the symbol onto the screen.
2. **Duplicate** the symbol by selecting it and choosing `Duplicate` from the `Edit` menu, or pressing `CTRL-D`. Now, select the duplicate symbol, which will be above the original.
3. Press the **Union** button ( ) in the toolbar or find the `Union` item under the `Shape` menu. This will flatten the duplicated shape into a single shape.
4. **Remove** the outline by setting the `Stroke Paint` property to *No Paint*.

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5. **Bind** the `Fill Paint` property to your `ValveStatus` tag. Add three entries into the number-to-color translation table: fully transparent for zero, 40% opaque green for 1, and 40% opaque red for 2.

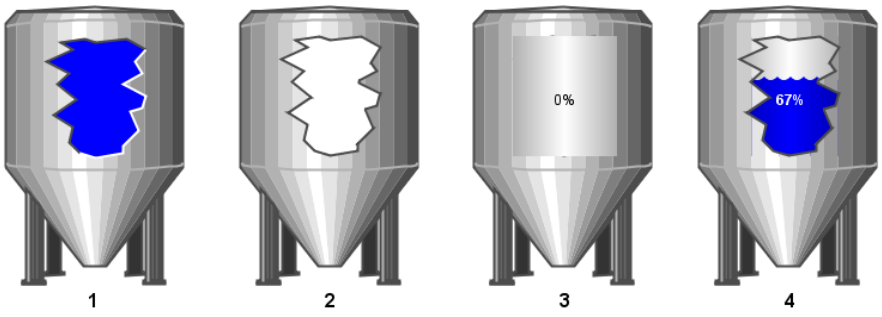
Understanding the tinting technique

In summary, what we did to tint the symbol was to make a flat shape that had the exact same outline as the symbol, and use semi-transparent fills to achieve a tint effect for the underlying symbol.

Symbol Factory Tip #2: Using Cutouts on Tanks

The symbols in the Tank Cutaways category work well when combined with the symbols in the Tank. Use the following technique to make a dynamic cutaway tank display:

1. Drag a tank and a cutaway symbol onto the window. Align the cutaway symbol on the tank where you'd like the cutaway to be placed.
2. Select the tank symbol, and then select the cutaway while holding `CTRL` to select both symbols. Press the Difference button ( ) to use the cutaway symbol to (you guessed it!) cut away that area out of the tank.
3. Place a Level Indicator component on the area removed by the cutaway.
4. Push the Level Indicator below the tank, and bind it to a SQL tag to create a dynamic display.



Dynamic cutaways are easy with vector-based symbols

5.7.4 Templates

5.7.4.1 Introduction

Templates are a simple but very powerful feature that you can use with your Vision windows. HMI and SCADA systems typically have quite a bit of repetition in their screens. For example, you might use a group of the same components over and over within your project to represent different motors. The data driving each set of graphics is different, but the graphics themselves are copies of each other.

Without templates, the only way to do this is to copy-and-paste the components each time you want to represent a motor. This is simple, and it works, but it can cause major headaches and time consuming corrections later on. If you ever want to make a change to how motors are represented, you're stuck

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making the change to each copy of the group.

Using templates, you define the graphics to display a motor in one place, called the *master template*. You can then use this template many times in your project on multiple windows. These are called *template instances*. Any changes made to the master template are then instantly reflected in all of the template instances. Using templates early in your project development for any repeating displays can save a significant amount of time later on.

5.7.4.2 Using Templates

Creating and using templates is very simple, and should be familiar to anyone who has designed Vision windows before. You should have the project you'd like to add a template to open in the Designer before you begin.

Creating a New Template

To create a new Template, right-click on the *Templates* node of the Project Browser, or choose *File* > *New* > *New Template* from the Designer's menu bar. This will create a new template.

Once you create a template, it will open the template master for design in the window workspace. To rename your template, click on it in the Project Browser and hit `F2`, or change the name in the property editor.

Editing a Template

You can open a template for editing by double-clicking on it in the project browser, or by double-clicking any instance of that template within a window. You design your template in the same way that you design windows: by adding components to it, and configuring those components using property bindings and scripting.

There are a few differences between templates and windows from an editing perspective. Templates, unlike windows, have a transparent background by default. This can be changed simply by editing the background color of the template. Templates also do not have the concept of a "Root Container" - the template itself acts like a container.

Creating a Template Instance

Once you've made your template, you can use it on any of the windows in your project. You can drag the template from the project browser into an open window, or you can right-click on the template and choose the *Use In Window* option, which will allow you to place the window inside a window with an additional click. The template instance can then be moved and resized like any other component.

5.7.4.3 Template Parameters

As a result of the primary use-case of templates being the ease of maintaining repeated user interface elements, proper use of parameters is paramount. Parameters are used to allow each template instance to reference different data elements of repeated data structures.

This is very similar to the concept of Parameterized Windows. In that case, any custom property on the root container of the window can be used as a parameter, passed into the window when it is opened. Templates take this idea one step further.

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Parameters and Internal Properties

When you open the Custom Properties customizer for a template master, you'll notice it is different than for all other components. Two kinds of custom properties are allowed: parameter properties and internal properties.

A *parameter property* will appear on each template instance, allowing each template instance to be configured differently. Commonly, this will be some sort of indirection. For example, if your template is for representing motors, then you might have `MotorNumber` as a parameter property. Then you could use that property as an indirection variable in other bindings within the template.

Parameter properties are not bindable from within the template master design. When you use the template to create a template instance, the property will become bindable. This ensures that the property only has a single binding configured for it.

An *internal property* cannot be used as a parameter. It will show up when designing the template master, but it will not show up on the template instances. Internal properties are bindable from within the template master design. These properties are intended to be used for the internal workings of the template.

Indirection and UDT Tags

There are two primary ways to achieve indirection when using templates. Let's continue to use the example of a motor. Your system has many motors in it, and your template is used to display the status of the motors and control the motor's running mode. The goal is to be able to drop instances of the template onto your windows, and configure them in a single step to point to the correct motor's tags.

If the tags representing the datapoints of each motor are arranged in an orderly fashion in folders or with a consistent naming convention, you can use standard indirection to configure your template. You'd add a parameter such as `MotorNum` to the template. Then you'd configure the contents of the template using indirect tag binding, where the value of `MotorNum` is used for the indirection.

If your motors are represented by a custom tag data type, then you can save some effort and use a property of that tag type directly. Make your indirection property the same type as your custom data type. Then you can use simple property bindings to configure the components inside your template. When you create a template instance, you can simply bind that property directly to the correct Motor tag, and all of the sub-tags of motor will be correctly mapped through the property bindings.

The Drop Target Parameter

You may choose one of your parameters as the drop target. This lets you drop tags onto your template instances to facilitate even quicker binding. For example, let's say that you have a parameter that is an integer and you've made it the drop target. If you drop an integer tag onto a window, your template will appear in the list of components that it suggests you make. Choosing your template will create a template instance and bind that parameter to the tag.

This also works for UDT tags. Lets say you have a custom data type called "Motor" and a template with a Motor-typed parameter set as the drop target. If you drop a motor tag onto a window, it'll create an instance of your template automatically. If you have more than one template configured with Motor drop targets, then you'll have to choose which template to use.

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5.7.5 Property Binding

5.7.5.1 Overview

Property Binding is perhaps the most important concept to understand when designing a project using the Vision module. It is primarily through property binding that you bring windows to life, and have them do useful things.

When you initially place a component on a screen, it doesn't really do anything. Changing its properties in the designer will make it look or act different, but it has no connection to the real world. This is what property binding adds. Property binding, as its name suggests, lets you *bind* a property to something else. That *something else* might be:

an OPC Tag
the results of a SQL query executed against a remote database
some other component's property
an expression involving any of these things
the results of a Python script
etc...

For example, bind the `value` property of an LED Display to an OPC SQLTag, and voilà - the `value` property will always be the value of that tag - creating a dynamic display. Bindings can also work the other way, using a *bidirectional* binding. Bind the value of a numeric text box to a tag, and that tag will be written to when someone edits the value in the text box.

The power of property bindings comes from the variety of different binding types that exist, and the fact that you can bind nearly *any* property of a component to anything else. Want it's foreground to turn red when an alarm is above a certain severity? Bind its LED Lit (`glyphForeground`) color to a tag's `AlertCurrentSeverity` property. Want it to only appear if a supervisor is on shift? Bind its `visible` property to the result of a SQL query that joins a personnel table with a shift table. The possibilities are, quite literally, endless.

How Bindings Work: Event-based vs Polling

While there are quite a few different binding types, they all boil down into two broad categories. Some complex bindings can span both categories.

Event-based bindings are evaluated when the object they are bound to changes. For example, when you bind a property to a SQLTag, that binding listens to the SQLTag, and every time the tag changes, it assigns the tag's new value into the property that it is on. If you bind the `value` of a Cylindrical Tank to the `value` of a Slider, then every time the slider changes, it fires a `propertyChangeEvent`. The binding is listening for this event, and when it is fired, updates the tank's `value`. The following bindings are event-based:
Tag bindings
Property bindings

Polling bindings are evaluated when a window first opens, on a timer, or when they change. For example, if you bind the `data` property of a Table to the results of a SQL query, that query will run on a timer, updating the Table every time it executes. The following bindings are based on polling:
SQL query bindings
some expression functions, like runScript() or now()

Many bindings can combine elements of a polling binding and event based binding. An expression binding may combine lots of other bindings to calculate a final result. A query binding will often itself be

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dynamic, altering the query based on other bindings.

For example, you might have a dropdown on a window that lets the operator choose a type of product that is produced. Then you can use a query binding like this to calculate the defect rate for the given product:

```
SELECT
   SUM(defective) / COUNT(*) AS DefectRate
FROM
   production_table
WHERE
   productCode = '{Root Container.ProductPicker.selectedValue}'
```

The red code is a binding inside of the query binding. Every time this (event-based) binding fires, the query will run again.

Using bindings like this, you can create highly dynamic and interactive screens with no scripting whatsoever.

5.7.5.2 Polling Options

For bindings that poll, you have a few options.

Polling Off
A polling-off binding will execute once when the window is opened, and then it will only execute again if it changes. The typical example of a binding that can change is a SQL query binding where it uses the brace-notation (`{}`) to include dynamic information inside the query. When this dynamic information changes the query, it will run again.

Relative Rate
The binding will execute at a regular rate, based on a delta off of the project's base polling rate. See Client Polling Properties. This is usually a good idea so that you can speed up or slow down an entire client's polling system in one place.

Absolute Rate
Using this option, you can specify an absolute rate for the binding to execute at, instead of one that is based off the relative rate.

5.7.5.3 Bidirectional Bindings

Tag bindings and Query bindings can be set up as bidirectional bindings. This means that not only is the binding assigning the tag value or query value into the property, but it is also listening for changes to that property, which will then be written back to the tag or the database.

Tag Bindings

Tag bindings can be made bidirectional simply by checking the checkbox. The "Fallback Delay" is the amount of time that the value will remain at the written value, waiting for a tag change to come in. If no tag change comes in within the allotted time (specified in seconds), then the property will fall-back to the value as it was before the write. This is needed, because sometimes even if a write succeeds, another write or ladder logic in a PLC might have written something different, even the old value, in which case no tag change event will be generated. As a rule of thumb, the fallback delay should be twice the tag's scan class rate.

Query Bindings

When a query binding is made bidirectional, it needs an UPDATE query to execute when the property changes. You can use the special marker `{this}` as a placeholder for the new value.

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Bidirectional query bindings are only available on scalar-typed properties (i.e. not Datasets)

5.7.5.4 Indirect Bindings

Making bindings indirect is an important part of the binding system. Indirect Tag, Expression, and SQL Query bindings can all be made indirect. All this means is that what the binding is bound to can be changed based upon the value of something else.

For example, instead of binding straight to a tag's path, like

```
[TagProvider]MyPlant/EastArea/Valves/Valve4/FlowRate
```

you can use other properties to make that path indirect. Suppose the "area" and valve number that we were looking at was passed into our window via parameter passing. Then we might use those parameters in the tag path, like this:

```
[TagProvider]MyPlant/{1}Area/Valves/Valve{2}/FlowRate
{1}=Root Container.AreaName
{2}=Root Container.ValveNumber
```

Now our binding will alter what tag it is pointing to based upon the values of those root container properties.

Making query bindings indirect, or dynamic, is so common that there are probably more indirect query bindings than direct ones. All this means is that the query is calculated dynamically. A common example of this would be to use a dynamic start date and end date in a query. Suppose we had a Classic Chart that we're binding to a range of history, and a Date Range that we wanted to have the operator use to select a time period. Then we could use an indirect query binding like this:

```
SELECT
   t_stamp, flow_rate, amps
FROM
   valve_history
WHERE
   t_stamp >= '{Root Container.DateRange.startDate}' AND
   t_stamp <= '{Root Container.DateRange.endDate}' AND
   valve = {Root Container.ValveNumber} AND
   area = '{Root Container.AreaName}Area'
```

See also:
Parameterized Windows

5.7.5.5 Binding Types

5.7.5.5.1 Tag Binding

A tag binding is a very straight-forward binding type. It simply binds to a tag property. This sets up a tag subscription for that tag, and every time the chosen property changes, the binding is evaluated, pushing the new value into the property.

If the tag is in a leased scanclass, this binding will activate the lease while the window is open.

If you choose a tag in the tree, and not a property, the `Value` property is assumed.

Bidirectional Mode
Choosing bidirectional will make this binding also write to the chosen tag when the property changes. The fallback delay is the amount of time to keep the property at the written value waiting for a new tag value update to come in. If no update arrives within the given timeout, the property falls back to the

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original value. See Bidirectional Bindings.

Overlay Opt-Out
Choosing this option will ignore the quality of the chosen tag, making it have no effect on the component's quality overlay.

5.7.5.5.2 Indirect Tag Binding

An indirect tag binding is very much like a standard tag binding. except that you may introduce any number of indirection parameters into the path. These parameters are numbered starting at one, and denoted by braces, e.g. `{1}`.

The binding will be bound to the tag represented by the tag path after the indirection parameters have been replaced by the literal values they are bound to. An indirection parameter may represent a property on any component in the same window, or the value of any tag.

Indirect tag bindings can use bidirectional mode just like standard tag bindings.

5.7.5.5.3 SQLTags Historian Binding

This binding type (which is only available for Dataset type properties), will run a query against the SQLTags Historian.

Selected Historical Tags
For this type of query, you must select at least one tag path to query. The Dataset returned by the query will have a timestamp column, and then a column for each path that you select here.

These paths may use indirection following the same rules as the Indirect Tag Binding. Simply type the indirection parameters (e.g. {1}) into a selected tag path by double-clicking in the list of selected paths. All valid parameters will appear in the lower indirection table.

Date Range
Choose either a *Historical* or *Realtime* query. Historical queries use a date range that must be bound in from other components on the screen, typically a Date Range or a pair of Popup Calendars. Realtime queries always pull up a range that ends with the current time, so all they need is a length.

Sample Size and Aggregation Mode
The sample size determines how the query results will look. A *Natural* query will look up the logging rate for the queried tags, and return results spaced apart at that rate. This means that the return size will vary with the date range. An *On Change* query will return points as they were logged. This means that the results may not be evenly spaced. A *Fixed* query will return the given number of rows. Where data was sparse, interpolated values will be added. Where data is dense, the *Aggregation Mode* will come into play.

The *Min/Max* aggregation mode will return the min and max for every timestamp. The *Average* aggregation mode will return the average timestamp for data within the underlying range.

Return Format
Return format dictates how the requested data will be returned. The options are "wide" (default), in which each tag has its own column, and "tall", in which the tags are returned vertically in a "path, value, quality, timestamp" schema.

SQLTags Historian information is often easiest to work with in the Easy Chart component, which

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handles all of these options automatically.

See also:
How SQLTags Historian Works
Data Types
system.tag.queryTagHistory

5.7.5.5.4 Property Binding

A property binding is a very simple type of binding. It simply binds one component's property to another. When that property changes, the new value is pushed into the property that the binding is set up on.

Why aren't all properties listed? You may notice that the list of properties available to bind *to* is smaller than the list of all properties. While nearly all properties can be *bound*, only some properties can be *bound to*. Only properties for which a `propertyChangeEvent` is fired may be bound to.

5.7.5.5.5 Expression Binding

An expression binding is one of the most powerful kinds of property bindings. It uses a simple expression language to calculate a value. This expression can involve lots of dynamic data, such as other properties, tag values, results of Python scripts, queries, etc.

Expressions can be used for many different purposes. Anytime information needs to be massaged, manipulated, extracted, combined, split, etc - think expressions.

Example
You have 3 bits in a PLC, only one of which will be on at a time. You want to turn these three bits into a single integer (0,1,2) to drive a component's Styles. Bind a custom integer property to:

```
binEnum({MyTags/Bit1}, {MyTags/Bit2}, {MyTags/Bit3})
```

Example
You have a Date, and need to extract the year, and concatenate the word "Vintage" to the end for a label display. Bind a label's `text` property to:

```
dateExtract({Root Container.VintageDate}, 'year') + ' Vintage'
```

Example
You have a button that starts a batch, but you only want to let it be pressed after the operator has entered a scale weight. Bind the button's `enabled` property to:

```
{Root Container.EntryArea.WeightBox.doubleValue} > 0.0
```

Example
You want to display a process's current state, translating a code from the PLC to a human-readable string, use of these two expressions (they're equivalent)

```
if ({CurrentProcessState} = 0, "Not Running",
if ({CurrentProcessState} = 1, "Warmup phase - please wait",
if ({CurrentProcessState} = 2, "Running", "UNKNOWN STATE")))
```

- or -

```
switch ({CurrentProcessState},
    0,1,2,
    "Not Running",
    "Warmup phase - please wait",
    "Running",
    "UNKNOWN STATE")
```

See also:
Expressions Overview

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5.7.5.5.6 DB Browse Binding

This binding is technically equivalent to the SQL Query binding, except that it helps write the queries for you. Using the database browser, you can pick the table that you want to pull content from. If you have a fixed range of data to choose, simply select it in the table, and watch the query get generated.

In the browse tree, you can choose which columns should act as your keys (these columns get put in the WHERE clause based on your selection) and which columns should be used to sort the data (these columns get put in the ORDER BY clause).

This binding type also serves as a convenient jumping-off point for the more flexible SQL Query binding. Construct the basic outline of your query in the DB Browse section, and then flip over to the SQL Query binding. Your query will be retained and can then be improved by hand.

5.7.5.5.7 SQL Query Binding

The SQL Query binding is a polling binding type that will run a SQL Query against any of the database connections configured in the Gateway.

Dynamic Queries

Using the brace notation, you can include the values of component properties (within the same window) and tag values inside your query. This is a very common technique to make your query dynamic. The values of the property or tag represented are simply substituted into the query where the braces are.

Note that because the substitution is direct, you'll often need to quote literal strings and dates to make your query valid. If you're getting errors running your query complaining about syntax, it is important to realize that these errors are coming from the database, not from Ignition. Try copying and pasting your query into the Query Browser and replacing the braces with literal values.

Example
A common requirement is to have a query filter its results for a date range. You can use the Date Range component or a pair of Popup Calendar components to let the user choose a range of dates. Then you can use these dates in your query like this:

```
SELECT
   t_stamp, flow_rate, amps
FROM
   valve_history
WHERE
   t_stamp >= '{Root Container.DateRange.startDate}' AND
   t_stamp <= '{Root Container.DateRange.endDate}'
```

Notice the single quotes around the braces. This is because when the query is run, the dates will be replaced with their literal evaluations. For example, the actual query sent to the database might look like this:

```
SELECT
   t_stamp, flow_rate, amps
FROM
   valve_history
WHERE
   t_stamp >= '2010-03-20 08:00:00' AND
   t_stamp <= '2010-03-20 13:00:00'
```

Fallback Value

If the property that is being bound is a *scalar* datatype (i.e. not a Dataset), then the value in the first column in the first row of the query results is used. If no rows were returned, the binding will cause an

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error unless the *Use Fallback Value* option is selected. The value entered in the fallback value text box will be used when the query returns no rows.

When binding a Dataset to a SQL Query, no fallback value is needed, because a Dataset will happily contain zero rows.

See also:
Polling Options
Creating a Database Connection

5.7.5.5.8 Cell Update Binding

The Cell Update binding enables you to easily make one or more cells inside a dataset dynamic. This particularly useful for components such as the Linear Scale or the Easy Chart, that store configuration information inside datasets.

For example, when you configure *indicators* on a Linear Scale component using that component's customizer, the indicators that you set up are stored in the "Indicators" property on the scale. Suppose you wanted high-setpoint and low-setpoint indicators on the scale that weren't simply static values, but actually bound to a SQLTag indicating the realtime high and low setpoints. In order to do this, you'd set up a Cell Update binding on the Linear Scale's Indicators property. You would configure two cell bindings - one for the low setpoint indicator's Value column, and one for the high setpoint. You would then bind these to the appropriate tags.

As another example, let's say you had an Easy Chart on a window that displayed 5 pens representing the history of a Compressor: running status, amperage, rpm, output pressure etc. Using SQLTags Historian, you had simply dragged the 5 applicable tags onto the Easy Chart. But now you want to use that same Easy Chart to dynamically display the same 5 pens of *any* of the many compressors in your system. To do this, you could pass the compressor number into the window as a parameter, and use it to calculate the tag path of the folder containing the pens. Then set up a Cell Update binding on the Easy Chart's "Tag Pens" property, dynamically altering the pens' tag paths. Now you have a generic chart window that can be used for any compressor.

Note that this binding type is only applicable for Dataset-typed properties.

5.7.5.5.9 Function Binding

This is a generic binding type that allows you to bind a dataset property to the results of a function. It allows any of the function's parameters to be calculated dynamically via tag and property bindings. The function that you choose determines the parameters that are available.

5.7.6 Component Scripting

5.7.6.1 Event Handlers

Event handling allows you to use scripting to respond to a wide variety of events that components fire. This lets you configure windows that are very interactive, and are an important part of project design in the Vision module.

Events

An event can be many things, like a mouse click, a key press, or simply a property changing. Whenever these events occur, a script can be called to "handle" the event. Different components can fire different types of events. For example, mouse events are very common and are fired by almost all components. The `cellEdited` event, on the other hand, is only fired by the Table component.

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Configuring Handlers

To configure event handlers for a component, right click on it and choose the *Event Handlers...* item. You can also get to this button vial the toolbar ( ) or the *Component* menu. Once in the event handler window, you can pick any event to handle. Each event can have its own handling logic.

Script Builders

All events are handled with scripting, but you frequently don't need to write the scripts by hand. This is where the *Script Builders* come in. For each event, you can choose a common way of handling the event. This can be a navigation action, setting a tag value, etc. To write an arbitrary script, choose the *Script Editor* tab.

For example, one of the most common uses of event handlers is to open a window when a button is pushed. To do this, simply select the `actionPerformed` event, and select the *Navigation* tab. Here you can simply pick the navigation action *Open*, and choose the window to open. If you're curious, you can peek over at the *Script Editor* tab to see the underlying code that makes this action tick, but you certainly don't have to.

See also:
About Scripting

5.7.6.2 The 'event' object

Event handling scripts are just regular Python scripts except for one important detail. They all have a special variable defined in their namespace called "`event`". This is an object that represents information about the event that just occurred. For example, the `event` object for a mouse click will have the x and y coordinates where the click occurred. A key press event, on the other hand, will have a keycode, but not a coordinate.

In addition to information about the event that has just occurred, the `event` object has a `source` property. The *source of an event is the component that fired it*. This is a crucial concept to understand. The reference to the component is your handle into the entire hierarchy of the window that your script is contained in.

Example
Suppose you're handling the mouse pressed event of a label component. The following script would print out the coordinates of the click, as well as the text of the label:

```
currentText = event.source.text
print 'Mouse clicked on label "%s" at %dx%d' % (currentText, event.x, event.y)
```

The output would look like this if the label's text was "this is my label":

```
Mouse clicked on label "this is my label" at 27x99
```

Using the `event` object to access the component hierarchy

Because `event.source` is the *component* that fired the event, you can use this reference to access the entire hierarchy of your window. This means you can access properties of any other component in the window. You just need to know how to navigate up and down the component tree.

To navigate *up* the component tree (going from a component to its *parent* container), simply use the `parent` property.
To navigate *down* the component tree (going from a container to one if its *children*) you use the `getComponent(name)` function.

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To navigate *sideways* (getting a reference to a *sibling* component) you simply go up one level and then back down.

Example
Suppose the component hierarchy in our window looked like this:

```
Root Container
   HeaderLabel
   StartButton
   Options
      ProductCode
      BatchSize
   PreviewTable
```

This window has a start button, a header, some options, and a preview table. Lets say that it is a window that lets the operator start a new batch. It has some options that are grouped into their own container. Lets say that the Root Container also has some parameters that our start button needs to know about.

The following table shows some script expressions and what they will evaluate to if you're writing an event handler for the StartButton component:

`event.source`
... the StartButton
`event.source.parent`
... the Root Container
`event.source.parent.MyProperty`
... the value of custom property "MyProperty" on the Root Container
`event.source.parent.getComponent("Options")`
... the Options container
`event.source.parent.getComponent("Options").getComponent("ProductCode").selectedValue`
... the selected value of the ProductCode dropdown component
`event.source.parent.getComponent("PreviewTable").selectedRow`
... the index of the selected row in the PreviewTable

⚠ There is one exception to the pattern of using `.parent` to go up the hierarchy and using `.getComponent(name)` to go down. The parent of a root container is *not* the window, and a reference to the window does not have a `.getComponent(name)` function. To get a reference to a window, simply use system.gui.getParentWindow with any component's `event` object as the parameter. Once you have a reference to a window, you can use its `.rootContainer` property to get to the root of the component hierarchy, and from here you can follow the rules laid out above.

See also:
Working with Components

5.7.6.3 Event Types

These are all of the event types that are fired by the various components in the Vision module. Events are organized into *event sets*. For example, the `mouse` event set includes `mouseClicked`, `mousePressed`, and `mouseReleased`. All of the events in an event set share the same properties for their `event` object.

Event Sets

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action
cell
focus
internalFrame
item
key
mouse
mouseMotion
paint
propertyChange

action Events

Events

actionPerformed

Properties in 'event'

source

The actionPerformed event is fired when an "action" occurs. What that "action" is depends on the component. The most common example is the Button component. You should always use the action event on a button instead of a mouse click, because it will be fired whenever the button is pressed, whether it is via the mouse or the keyboard (via a mnemonic shortcut or tabbing over to the button and pressing enter or space). The Timer component is another example of a component that fires an action event. In this case, the action is the timer firing.

cell Events

Events

cellEdited

Properties in 'event'

source

oldValue - the previous value in the cell

newValue - the newly entered value for the cell

row

column

Cell events are fired by a Table component that has editable columns. When a user edits a cell, this event will fire. The oldValue and newValue properties in the event can be used to determine what value the cell used to hold, and what new value the user has entered. The row and column properties, both integers, show what position in the table's data property the edit occurred at.

Example

Commonly, the event handler for a cell event will issue a SQL update query to persist changes to the table back to an external database. You can use the row to determine what the primary keys were for the row that was edited by looking at the table's data property. You can use the column index to find the column name of the edited column.

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```
columnName = event.source.data.getColumnName(event.column)
primaryKeyValue = event.source.data.getValueAt(event.row, "keycolumn")
query = "UPDATE mytable SET %s=? WHERE keycolumn=?" % columnName
system.db.runPrepUpdate(query, [event.newValue, primaryKeyValue])
```

`focus` Events

Events

`focusGained`

`focusLost`

Properties in '`event`'

`source`

`oppositeComponent` - the component that either gave up focus to this component, or took it away

Focus events are fired for components that can receive input focus. For both the focus gained and focus lost events, you can also access the "opposite" component. For a focus gain, this is the component that previously had the focus. For a focus lost event, the opposite component is the component that took the focus away.

You can programatically request that focus be given to a component by calling the function `requestFocusInWindow()` on that function. This function is actually defined by Java's JComponent class, from which all Vision components extend.

If you are trying to alter the focus from within a focus event handler, you must wrap your code in a call to system.util.invokeLater. This will let your focus change be processed *after* the current focus change event that is being processed has a chance to finish.

`internalFrame` Events

Events

`internalFrameActivated` - fired when the window becomes the focused window

`internalFrameClosed` - fired after the window is closed

`internalFrameClosing` - fired just before the window is closed

`internalFrameDeactivated` - fired when the window loses focus

`internalFrameOpened` - fired the *first* time a window is opened after *not* being in the cache

Properties in '`event`'

`source`

Internal frame events are fired by windows. (They are known as "internal frames" in the underlying Java windowing system that the Vision component uses). Note that the source of these events is the window itself. To get the root container of the window, use `event.source.rootContainer`, *not* `event.source.getComponent("Root Container")`.

The Activated/Deactivated events get fired when the component receives or loses input focus. The Activated event is a more reliable event to use as a window startup event than the Opened event, because the Opened event will *not* be called if the window was opened when it was already cached.

See also:

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Window Cache Policies

item Events

Events

itemStateChanged

Properties in 'event'

source

stateChange - a code that will be equal to either the SELECTED or DESELECTED constants.

SELECTED - a constant representing a selection event.

DESELECTED - a constant representing a deselection event.

The itemStateChanged event is used by components that choose between a *selected* or *deselected* state. For example, a Check Box or Radio Button. You can respond to this event to be notified when the state has changed (via any mechanism - click, keyboard, property bindings, etc). To check whether the event represents a selection or a deselection, you compare the event's stateChange property with the SELECTED or DESELECTED constants, like this;

```
if event.stateChange == event.SELECTED:
   print "Turned ON"
else:
   print "Turned OFF"
```

key Events

Events

keyPressed - fires when a key is pressed while the source component has input focus. Works for all keyboard keys.

keyReleased - fires when a key is released while the source component has input focus. Works for all keyboard keys.

keyTyped - fired when a *character* key is pressed and then released while a component has input focus.

Properties in 'event'

source

keyCode - an integer code representing the key that was pressed or released. Only valid on keyPressed and keyReleased events. See table below.

keyChar - a string that represents the character that was typed, if applicable (e.g. used for letters, but not an F-key). Only valid on keyTyped event.

keyLocation - the location of the key. E.g. to differentiate between left shift from right shift.

altDown - true (1) if the alt key was held down during this event, false (0) otherwise.

controlDown - true (1) if the control key was held down during this event, false (0) otherwise.

shiftDown - true (1) if the shift key was held down during this event, false (0) otherwise.

Key events are used to respond to keyboard input. They will only be fired on components that receive input focus. Handling key events often involves checking exactly what key was pressed. These events make a distinction between *character* keys (A,B,C...) and non-printable keys (F3, Esc, Enter

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). All keys will get `keyPressed` and `keyReleased` events, but only character keys will get `keyTyped` events. For `keyTyped` events, checking what key was pressed is relatively simple, you can simply do a comparison on `keyChar`, like `event.keyChar == 'a'`. For other keys, however, you need to compare the keyCode to a constant, enumerated below. These constants can be referenced through the event object itself, like: `event.keyCode == event.VK_ENTER`.

Key Code Constants

VK_0 - VK_9	VK_END	VK_PAGE_UP
VK_A - VK_Z	VK_ENTER	VK_RIGHT
VK_F1 - VK_F24	VK_HOME	VK_SHIFT
VK_ALT	VK_INSERT	VK_SPACE
VK_CONTROL	VK_LEFT	VK_TAB
VK_DOWN	VK_PAGE_DOWN	VK_UP

Location Code Constants

KEY_LOCATION_LEFT	KEY_LOCATION_RIGHT	KEY_LOCATION_UNKNOWN
KEY_LOCATION_NUMPAD	KEY_LOCATION_STANDARD	*(indeterminate or irrelevant)*

All of this information comes straight out of the Java documentation for `java.awt.KeyEvent`. See http://java.sun.com/j2se/1.5.0/docs/api/java/awt/event/KeyEvent.html

`mouse` Events

Events

`mouseClicked` – fired when the mouse is pressed and released in the same spot on the component.

`mouseEntered` – fired when the mouse is moved so that it is hovering over the component

`mouseExited` – fired when the mouse had been hovering over the component and exits

`mousePressed` - fired when the mouse is pressed within the bounds of the component

`mouseReleased` - fired when the mouse is released after having been pressed within the bounds of the component

Properties in '`event`'

`source`

`button` – an integer code representing the button that was clicked. Use the constants `event.BUTTON1`, `event.BUTTON2`, and `event.BUTTON3`.

`clickCount` – an integer count of the number of successive clicks.

`x` – the x-axis location of the mouse click, with (0,0) being the upper left corner of the component.

`y` – the y-axis location of the mouse click, with (0,0) being the upper left corner of the component.

`popupTrigger` – true(1) if this mouse event should pop up a context menu. Meaning is OS-dependent. On windows, it is a release of `BUTTON3`.

`altDown` – true (1) if the alt key was held down during this event, false (0) otherwise.

`controlDown` – true (1) if the control key was held down during this event, false (0) otherwise.

`shiftDown` – true (1) if the shift key was held down during this event, false (0) otherwise.

`mouseMotion` Events

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Events

`mouseDragged` - fires when the mouse is pressed within the component, and then moved. Will continue to fire until the button is released, even if the mouse moves outside the component.

`mouseMoved` - fired when the mouse moves over the component.

Properties in '`event`'

see mouse events.

`paint` Events

Events

`repaint`

Properties in '`event`'

`source`

`graphics` - An instance of `java.awt.Graphics2D` that can be used to paint this component. The point (0,0) is located at the upper left of the component.

`width` - The width of the paintable area of the component. This takes into account the component's border.

`height` - The height of the paintable area of the component. This takes into account the component's border.

This event is fired by the Paintable Canvas component. This component is provided for highly script-literate users, and is decidedly *not* user-friendly. Don't say you weren't warned. It allows you to use Java2D through Python to programatically "paint" your own dynamic, vector-based component. This event is called every time the component needs to repaint. It will repaint when any of its custom properties change, or when `.repaint()` is called on it. Drop a Paintable Canvas onto a window and look at the paint event handler for an example.

`propertyChange` Events

Events

`propertyChange`

Properties in '`event`'

`source`

`newValue` - The new value of the property

`oldValue` - The previous value of the property. Not all properties provide this information.

`propertyName` - The name of the property that has changed.

The `propertyChange` event is called any time a *bindable* property changes on a component. This includes all custom properties. This can be a very useful tool, allowing you to respond via scripting when a property changes. Because this one event handler is called for multiple properties, it is typical for a handler to first have to filter based on the `propertyName`, so that it is responding to a specific property changing.

Example

```
#This script might go on a Table whose data must be filled in before continuing
if event.propertyName == "data":
   newData = system.db.toPyDataSet(event.newValue)
```

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```
if len(newData)>0:
    # Data exists - let the user know they may proceed
    system.gui.messageBox("You may proceed.")
```

5.7.6.4 Script Builders

When creating an event handler, you can use one of the handy "script builders" instead of writing the script by hand. In the Event handlers configuration window, the script builders are accessible as tabs along the top. The last tab, "Script Editor", lets you write an event handler by hand. You can also use it to view the script that was generated by the script builder, which is a good way to get started learning how to write event handlers by hand.

Action Qualifiers
All of the script builders allow you to put security and/or confirmation qualifiers onto the event handler. The security qualifier lets you restrict the event handler from running if the current user doesn't possess a set of roles. Use CTRL-select to pick multiple roles. The confirmation qualified will prompt the user with a popup Yes/No box. The action will only be executed if the user chooses "Yes".

Navigation

The navigation script builder has various functions that deal with opening and closing windows.

Open / Swap
Opening is a very straight-forward operation - it simply opens the specified window. You are also given options to then center that window within the Client, and to close the window that the event was fired from.

S*wapping* is the practice of opening another window in the same size, location, and state as the current window, and closing the current window. This gives the appearance of one window simply swapping into another, seamlessly. The navigation builder uses the swapWindow version of swapping, but most "by hand" script authors will us the swapTo version. This last version relies on the fact that the windows being swapped are both maximized windows. See the typical navigation strategy section for more information.

You can also pass *parameters* to the opened or swapped-to window. The names of these parameters must match names of custom properties on the root container of the target window. The values can either be literals or values of other properties from the source window. To use a property, highlight an empty cell in the Value column of the parameter table, and press the Insert Property ( ) button. See the parameterized windows section for more information.

Forward / Back
These action give you a simple way of implementing "browser"-style forward/back buttons in your client. Note that you must be using the default navigation strategy for this to work, because these functions rely on calls to `system.nav.swapTo` in order to keep track of what the sequence of recent windows has been.

Closing Windows
These options allow for an easy way to have an event handler close the window that it is a part of, or any other window.

See also:

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Parameterized Windows
Typical Navigation Strategy
system.nav.openWindow
system.nav.swapWindow

Set Tag Value

This event handler script builder will respond to an event by setting the value of a SQLTag. You can set the tag to either a literal value directly typed in, or you can use the Insert Property ( ) button to have the handler use the value of another property from the same window.

SQL Update

This script builder helps you build an update query using a database browsing interface. Choose a spot in your target database and the update query will be built for you. By setting columns as key columns, you can have the filter correctly filter to the right row. You may use either literal values or property values by using the Insert Property ( ) button next to the *Update Value* text box.

Set Property

This script builder will respond to an event by altering a property in the window. You must choose the property to alter, and the value that you wish to assign to it. The value can be a literal value or the value of any other property on the window by using the Insert Property ( ) button.

5.7.7 Security

5.7.7.1 Role-based access

Security is configured using *roles*. This simple concept just means that instead of granting or revoking privilege based on *user*, you do so based upon the more abstract concept of a *role*, and then you assign users to belong to one or more roles.

The maintenance ramifications of this separation are fairly obvious - you define your security based upon the process, not the people. Ideally, the process remains constant even if the cast of characters changes. As people are hired, transferred, promoted, fired, etc, the security management simply becomes the re-assigning of roles, not the re-designing of your project.

Project Required Roles

The coarsest level of security for a Vision project is the project's *Required Roles* property. This is a list of roles that the user must have *all* of in order to log into the Client.

See also
Project General Properties
Gateway Configuration - Security Overview

5.7.7.2 Tag Security

SQLTags security is often the best way to configure security for data access. By defining security on a tag, you affect the tag across all windows in the project, as opposed to configuring component security on each component that displays or controls that tag.

If a user opens a window that has components that are bound to a tag that the user doesn't have

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clearance to read or write to, the component will get a *forbidden* overlay.

Tag security in action

See also:
Quality Overlays
Tag Permissions

5.7.7.3 Component Security

Each window and component can define its own security settings. These settings determine who can see and/or use the component. To define security for a component, right click on it and choose "Component Security". Here you can choose to implement a security policy different than that of your parent.

In the Client, if the user does not match the role filter that you define, the component will be disabled or hidden and disabled. If a user with higher privileges logs in, the component will be useable again.

⚠ If you choose to *disable* a component, make sure that it is a component that actually *does something different* when it is disabled. For example, buttons and input boxes can't be used when they are disabled, but disabling a label has no effect.

5.7.7.4 Securing event handlers

Event handlers often execute logic that must be secured. The various script builders all have special security qualifiers that can be enabled. These qualifiers get translated into the generated script by accessing the user's current roles via scripting.

Example

```
if 'Administrator' in system.security.getRoles():
   productCode = event.source.productCode
   qty = event.source.parent.getComponent("QuantityBox").intValue
   query = "UPDATE my_secure_table SET quantity=? WHERE product=?"
   system.db.runPrepUpdate(query, [qty, productCode])
else:
   system.gui.errorBox('Insufficient security privileges.')
```

See also:
Script Builders
system.security.getRoles

5.8 Reporting Module

5.8.1 Introduction

Welcome to Ignition Reporting!

Ignition Reporting is a module for creating dynamic reports! These reports may be generated from existing Adobe Acrobat (pdf) files or created totally from scratch. Data is

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introduced through Ignition, providing access to any SQL database!

Ignition Reporting makes creating professional reports easy with a rich library including: images, graphs, tables, and a variety of basic shape tools. Access to reports is web based via the Ignition runtime, a Java application, providing authenticated users access from anywhere, all based on networking standards that your IT department can support. Reports are printer friendly and can easily be exported to a variety of formats including pdf! Here are some common uses of dynamic reports:

- Production Management
- Efficiency Monitoring
- Downtime Tracking
- Statistical Process Control
- Quality Assurance
- Overall Equipment Effectiveness (OEE) Management
- Historical Data analysis

Benefits

Ignition Reporting enables managers to increase productivity, decrease waste, reduce costs, and increase quality with existing resources by providing an view of their manufacturing process. Managers often save time by automating reporting processes that were once done by hand. Often valuable man hours that went into creating spreadsheets or reports can be recovered! These reports are trivial to manage since they are generated on the fly from existing SQL database data.

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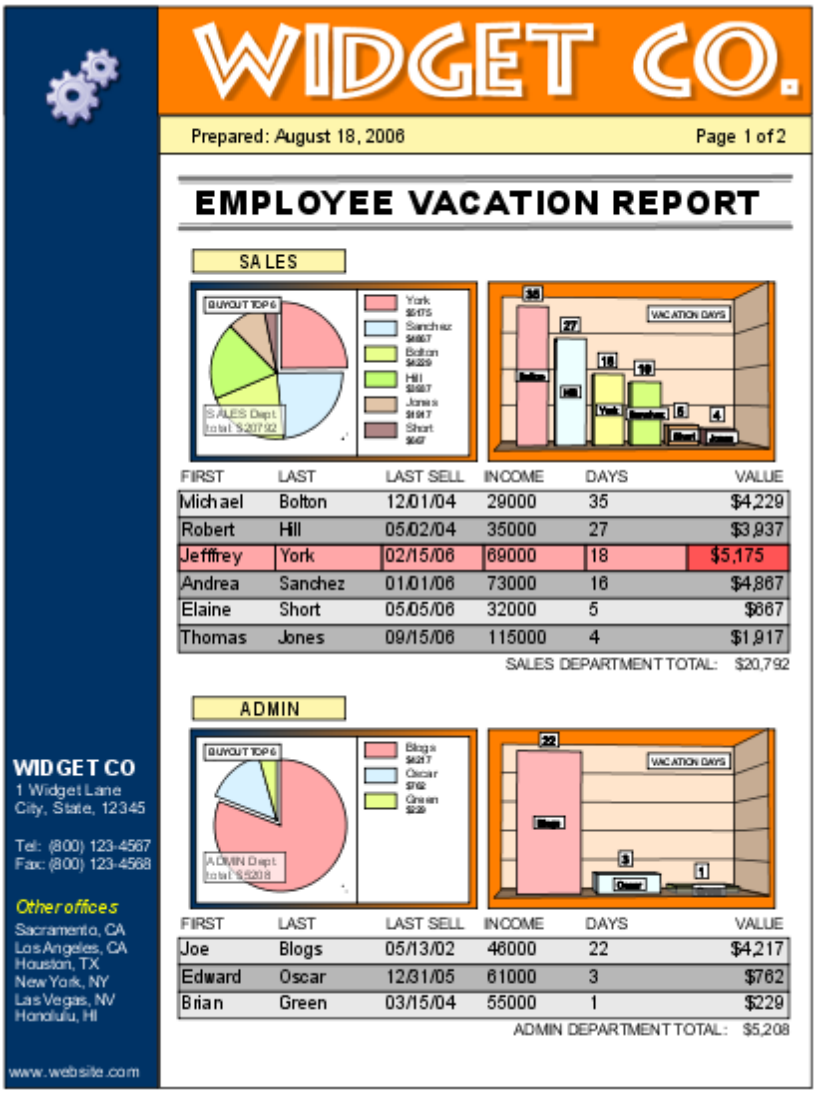

WIDGET CO.

Prepared: August 18, 2006 Page 1 of 2

EMPLOYEE VACATION REPORT

SALES

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Michael	Bolton	12/01/04	29000	35	$4,229
Robert	Hill	05/02/04	35000	27	$3,937
Jefffrey	York	02/15/06	69000	18	$5,175
Andrea	Sanchez	01/01/06	73000	16	$4,867
Elaine	Short	05/05/06	32000	5	$667
Thomas	Jones	09/15/06	115000	4	$1,917

SALES DEPARTMENT TOTAL: $20,792

ADMIN

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Joe	Blogs	05/13/02	46000	22	$4,217
Edward	Oscar	12/31/05	61000	3	$762
Brian	Green	03/15/04	55000	1	$229

ADMIN DEPARTMENT TOTAL: $5,208

WIDGET CO
1 Widget Lane
City, State, 12345

Tel: (800) 123-4567
Fax: (800) 123-4568

Other offices
Sacramento, CA
Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI

www.website.com

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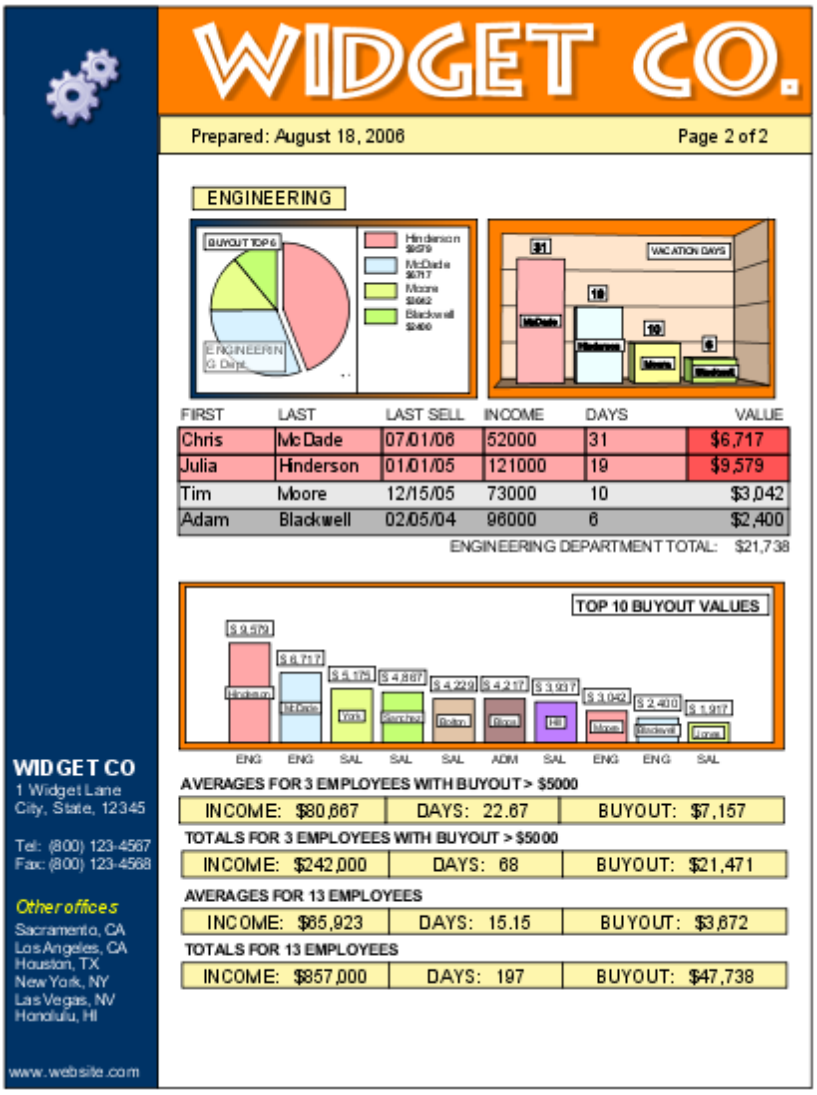
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Prepared: August 18, 2006
Page 2 of 2
ENGINEERING
VACATION DAYS
FIRST LAST LAST SELL INCOME DAYS VALUE
Chris McDade 07/01/06 52000 31 $6,717
Julia Hinderson 01/01/05 121000 19 $9,579
Tim Moore 12/15/05 73000 10 $3,042
Adam Blackwell 02/05/04 96000 6 $2,400
ENGINEERING DEPARTMENT TOTAL: $21,738
TOP 10 BUYOUT VALUES
AVERAGES FOR 3 EMPLOYEES WITH BUYOUT > $5000
INCOME: $80,867 DAYS: 22.67 BUYOUT: $7,157
TOTALS FOR 3 EMPLOYEES WITH BUYOUT > $5000
INCOME: $242,000 DAYS: 68 BUYOUT: $21,471
AVERAGES FOR 13 EMPLOYEES
INCOME: $85,923 DAYS: 15.15 BUYOUT: $3,672
TOTALS FOR 13 EMPLOYEES
INCOME: $857,000 DAYS: 197 BUYOUT: $47,738
WIDGET CO
1 Widget Lane
City, State, 12345
Tel: (800) 123-4567
Fax: (800) 123-4568
Other offices
Sacramento, CA
Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI
www.website.com
Report created in Tutorial #2.

Help File Organization

This help file is organized in 4 main sections:

Introduction
Provides the basic information needed to get started, including how to install and activate. Goes over Ignition reporting features and how it works with the Ignition system.

Tutorials
Introduces you to the Report Designer by stepping you through creating simple, yet powerful example reports. This is a great place to consider what can be created with Ignition Reporting.

Components
Broken down to two sections. *Ignition Components* interface directly with your Ignition project. *ReportViewer Components* are strictly used within the Report Designer. They are

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the tools that allow the creation of professional reports.

Concepts
User Interface concepts go over the way that report customization works within the Report Designer. *Basic* and *Advanced* concepts discuss various aspects of Ignition Reporting. This is a good section to begin reading early to learn what Reporting is all about. Re-read this section after you have become proficient with the interface to gain a full understanding of how Report Generation works.

Extended Help

As no manual can fully cover every conceivable situation or topic, it's important that you know where to go for answers. The first and best place is the Inductive Automation Web site and the Inductive Automation Forum, where you can peruse the issues and questions that other users have encountered. We will respond to your posts by the next business day.
From there, you may E-mail Us. We strive to provide a quick turn around on answers - usually within 24 hours.
Finally, registered users may call us toll-free at 1-800-266-7798.

5.8.1.2 Features

The most noteworthy feature of *Ignition Reporting* is the fact that is integrated into the *Ignition* system. This: provides access to *Ignition* data including any SQL database, allows an unlimited number of concurrent clients via web based access, and shares authentication with your existing *Ignition* project.

Other features:

Easy to use WYSIWYG (What you see is what you get) designer that includes an intuitive layout and drawing tools

Powerful table tool that creates new pages to fit your data. It supports a wide range of features.

Ability to start with an existing pdf report for automatic form fill-in.

Reports are printer friendly.

Every report can be saved by the user in a variety of formats including pdf.

The Reporting Module includes the Row Selector and Column Selector components. Both are very useful when working with DataSets. They work especially well with *Ignition* graph and table components as well as the Report Viewer.

The Reporting Module includes the File Explorer and PDF File Viewer components. These are very useful for viewing machine maintenance manuals or any other PDFs from within your project.

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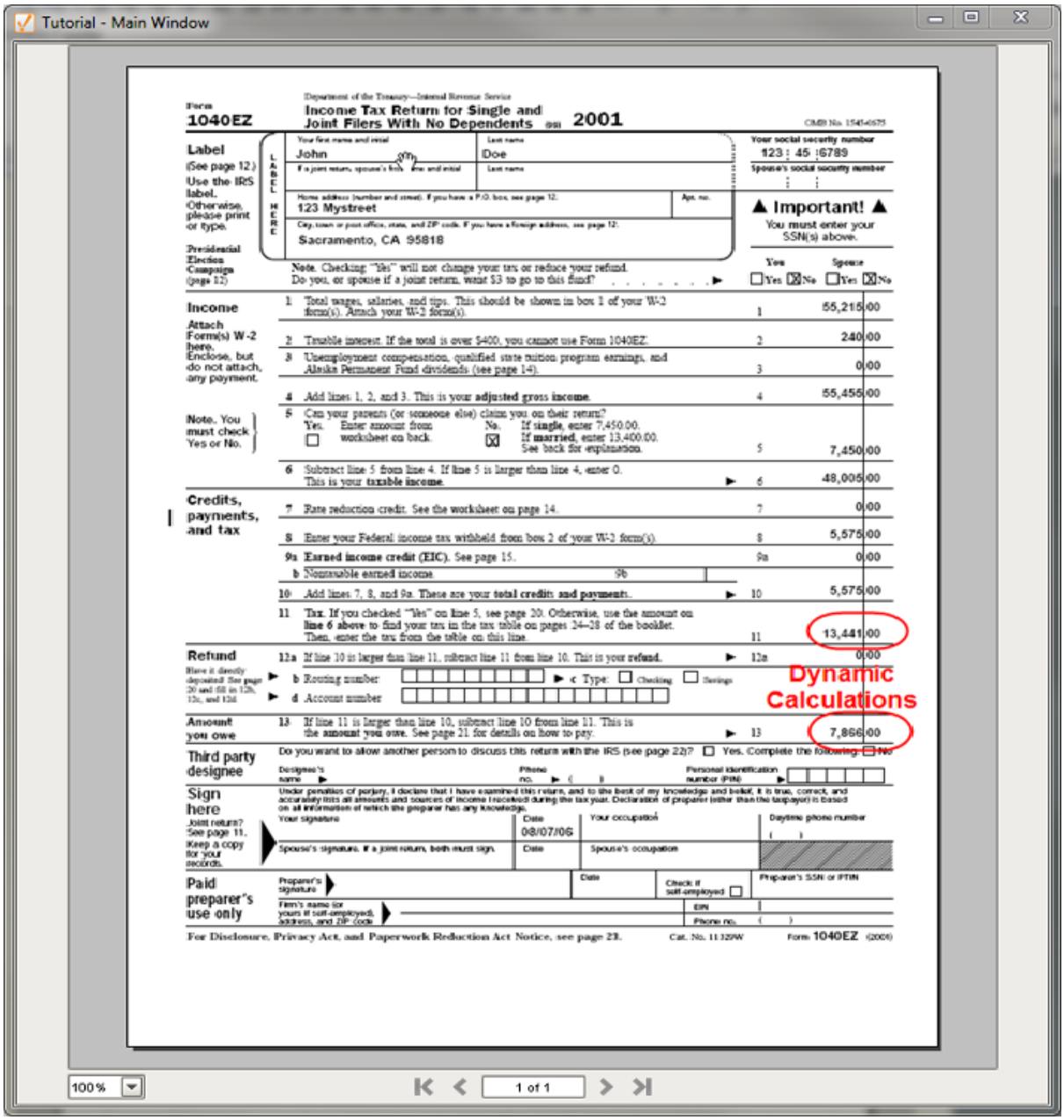

Example report based on existing pdf

5.8.1.3 How it works

When you install the *Ignition Reporting* module a **Reporting** tab appears in the designer that contains the following:

Row Selector

Column Selector

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Report Viewer

File Explorer

PDF Viewer

Simply use these objects as you would any Ignition components. The bulk of creating your professional report is done through the Report Designer, which is the customizer (Cntl+U) for the Report Viewer.

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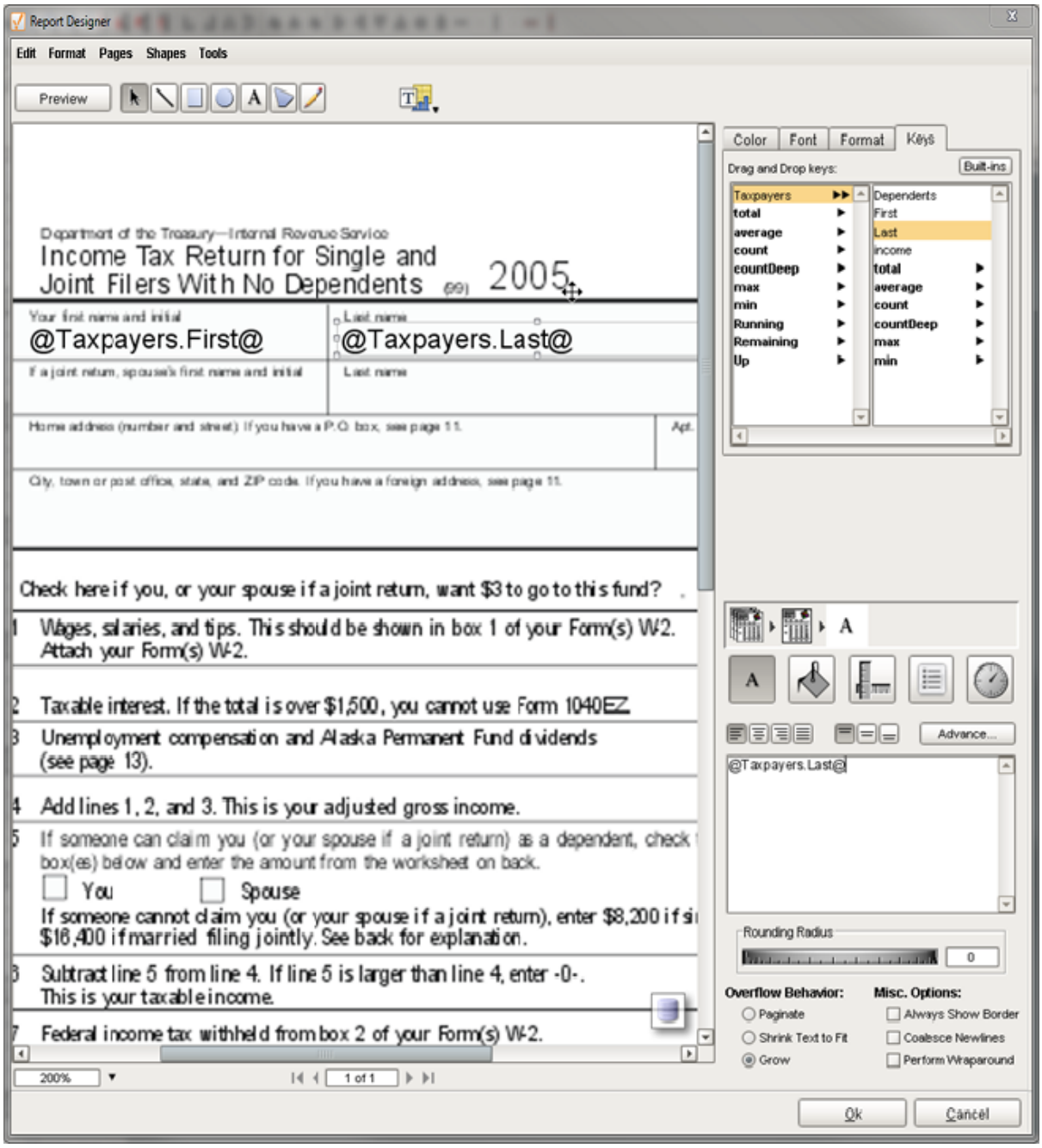
Report Designer
Edit Format Pages Shapes Tools
Preview
Department of the Treasury—Internal Revenue Service
Income Tax Return for Single and
Joint Filers With No Dependents (99) 2005
Your first name and initial
@Taxpayers.First@
Last name
@Taxpayers.Last@
If a joint return, spouse's first name and initial
Last name
Home address (number and street). If you have a P.O. box, see page 11.
Apt.
City, town or post office, state, and ZIP code. If you have a foreign address, see page 11.
Check here if you, or your spouse if a joint return, want $3 to go to this fund?
1 Wages, salaries, and tips. This should be shown in box 1 of your Form(s) W-2. Attach your Form(s) W-2.
2 Taxable interest. If the total is over $1,500, you cannot use Form 1040EZ.
3 Unemployment compensation and Alaska Permanent Fund dividends (see page 13).
4 Add lines 1, 2, and 3. This is your adjusted gross income.
5 If someone can claim you (or your spouse if a joint return) as a dependent, check box(es) below and enter the amount from the worksheet on back.
You
Spouse
If someone cannot claim you (or your spouse if a joint return), enter $8,200 if si $16,400 if married filing jointly. See back for explanation.
6 Subtract line 5 from line 4. If line 5 is larger than line 4, enter -0-. This is your taxable income.
7 Federal income tax withheld from box 2 of your Form(s) W-2.
200%
1 of 1
Color Font Format Keys
Drag and Drop keys:
Built-ins
Taxpayers
total
average
count
countDeep
max
min
Running
Remaining
Up
Dependents
First
Last
income
total
average
count
countDeep
max
min
Advance...
@Taxpayers.Last@
Rounding Radius
0
Overflow Behavior:
Paginate
Shrink Text to Fit
Grow
Misc. Options:
Always Show Border
Coalesce Newlines
Perform Wraparound
Ok
Cancel

Example pdf report in the Report Designer

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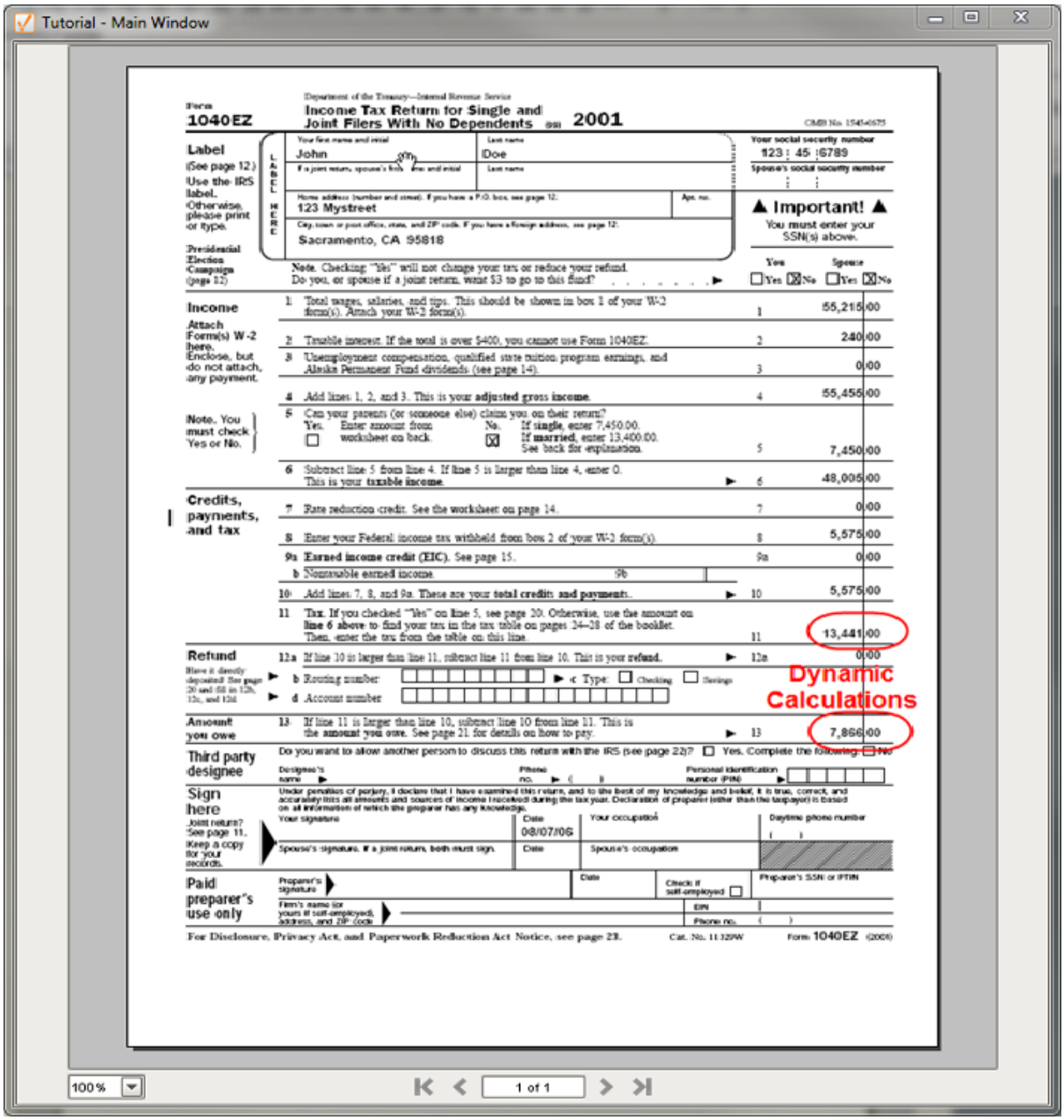
Tutorial - Main Window
Form 1040EZ
Income Tax Return for Single and Joint Filers With No Dependents 2001
Dynamic Calculations
100%
1 of 1

Viewing report in the Ignition Runtime

5.8.1.4 Installation and trial mode

Installation

Installing the Ignition Reporting module is a simple process done in the Ignition web configuration. From the Gateway Configuration Page do the following

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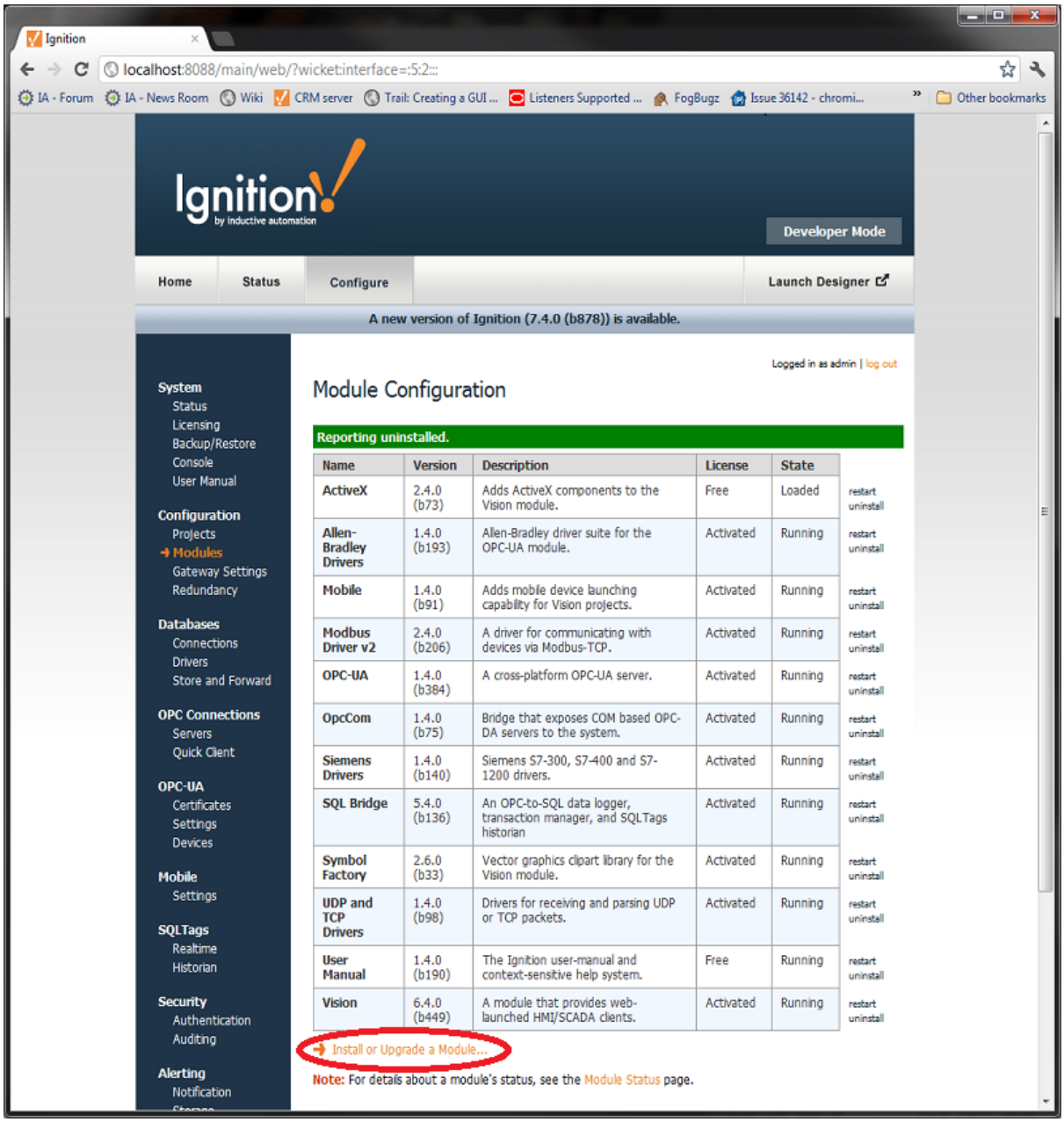

Fig. 1: Go to the Modules section, then click the "Install or Upgrade a Module" icon

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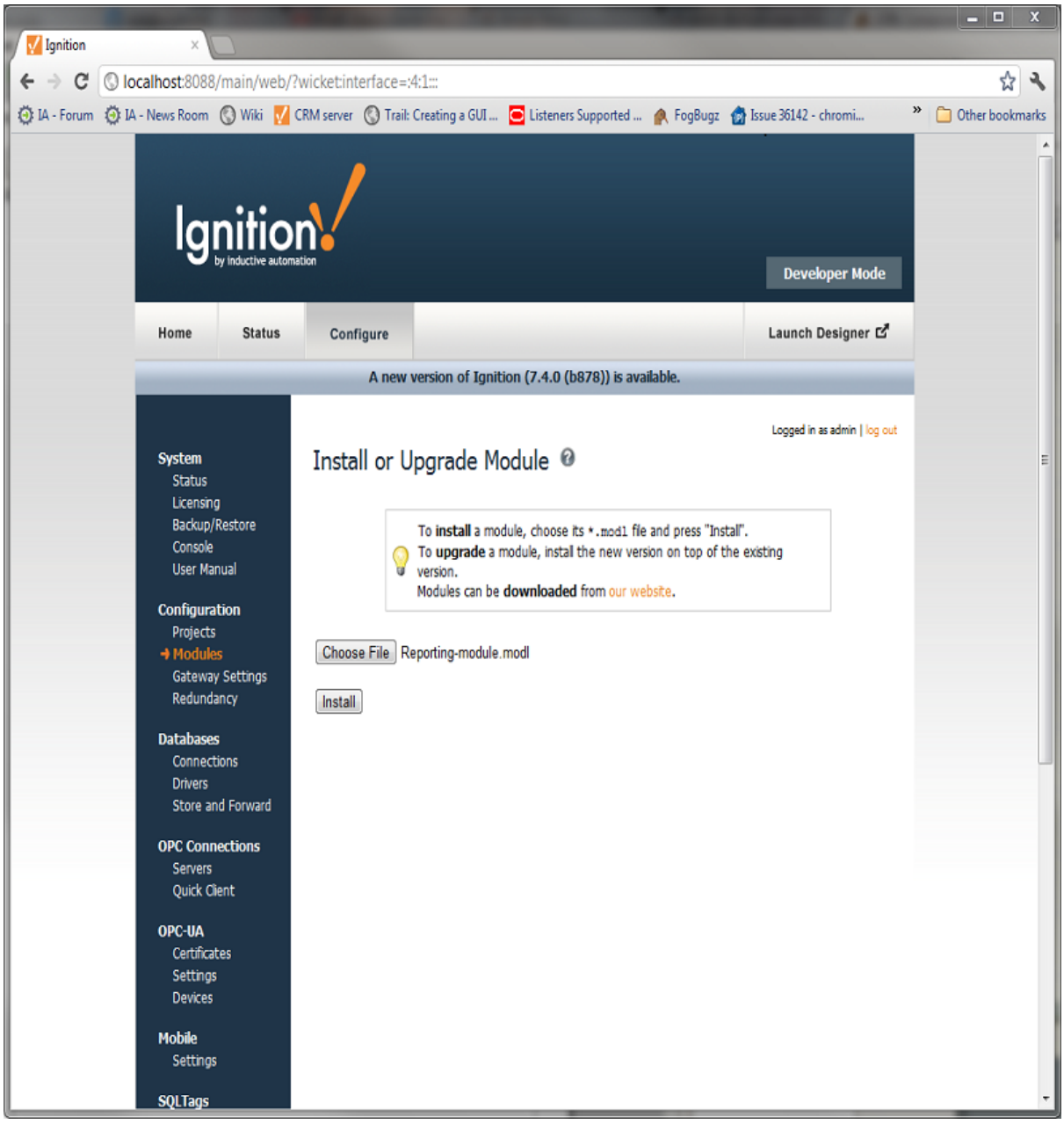

Fig. 2: Select the Reporting Module .modl file and click Install.

Trial Mode

The Ignition Reporting module trial works in a similar fashion as Ignition's trial mode.

The trial mode provides a way for you to try our software without any feature restrictions. This allows you to fully evaluate our software to make sure that it's right for you. In the trial mode, all reports will have a watermark on them displaying the fact that the reporting module is being run in trial mode. In addition, after two hours of cumulative runtime, the module will 'timeout'. When the module times out, the Row Selector and Column selector components will have a watermark on them, and the report component

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will no longer be able to print or save to PDF. You can log into the Ignition Gateway and reset the trial timer, which resets the two-hour timeout period. You can do this as many times as you want, which means that you can evaluate it for as long as you want! This system gives you flexibility to evaluate our product, while making it impractical for industrial use.

Running Ignition Designer does not cause your trial window to decrease. This means that you can design an entire project on an un-activated Ignition Gateway.

5.8.1.5 Getting Started

Ignition Reporting is really pretty easy to use. A basic grasp of the following topics, shown in order of precedence, will have you on your way to creating professional reports:

Understand how data gets into the report via dynamic properties.

Read how selection works. Pay close attention to superselection. This is **very important**!

Know that all properties can be modified via the attribute panel or the inspector panel once you select the right object.

Understand that substitution keys are the way that reports display dynamic data.

When working with tables and graphs, the DataSet Key defines the Ignition DataSet that will populate the object. Once defined, you may implicitly specify variables under that dataset.

At this point click through the Quick Start or Tutorial #1.

5.8.1.6 Step by Step Quick Start

This guide steps you through creating basic report that contains a table and pie chart with the default DataSet, *Data*, shown below. Click here to learn how to install the *Ignition Reporting module* or here to learn how to populate the report with your own data.

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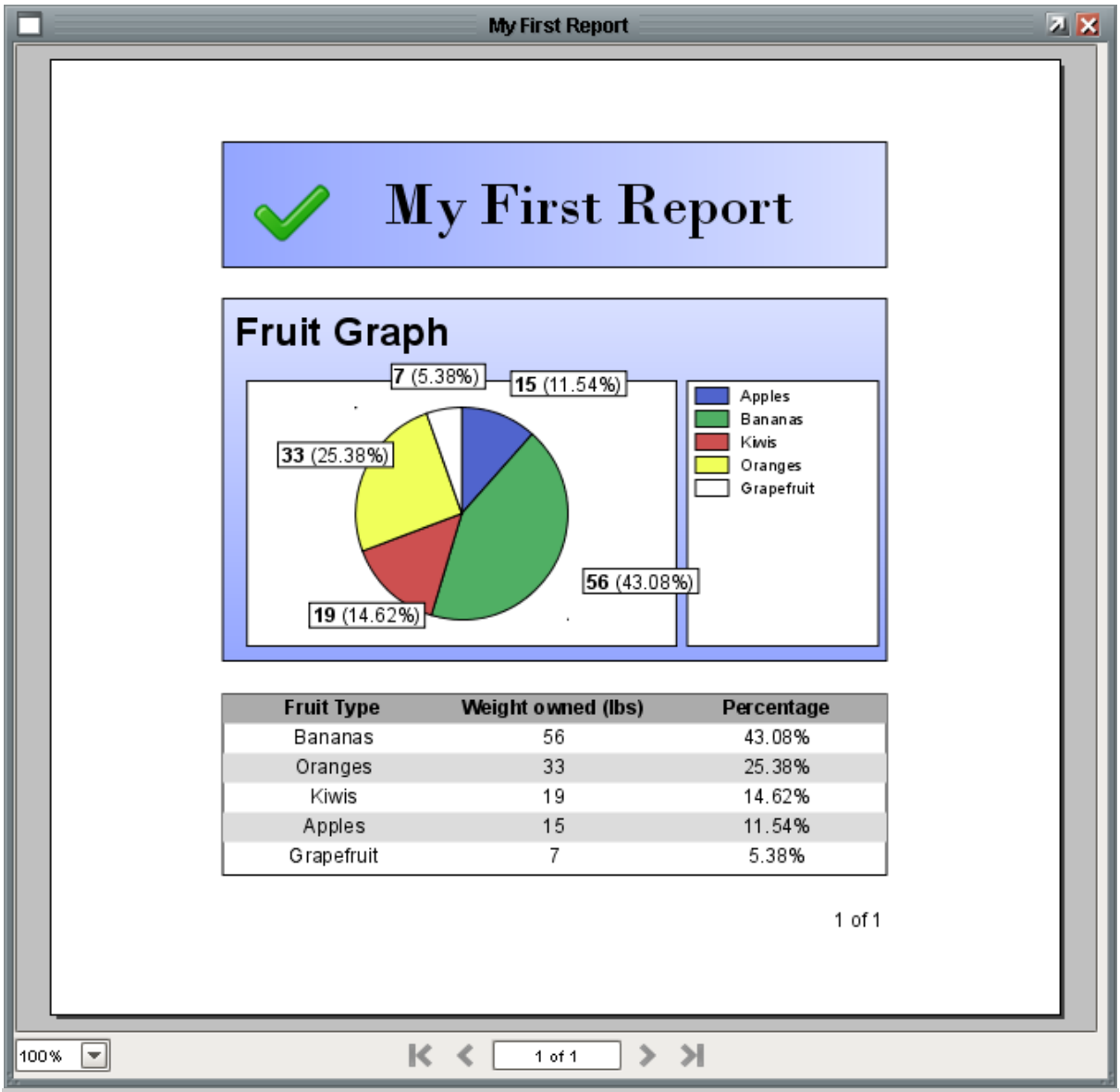

Instructions

We begin with the default DataSet, *Data*, that comes attached to every Report Viewer.

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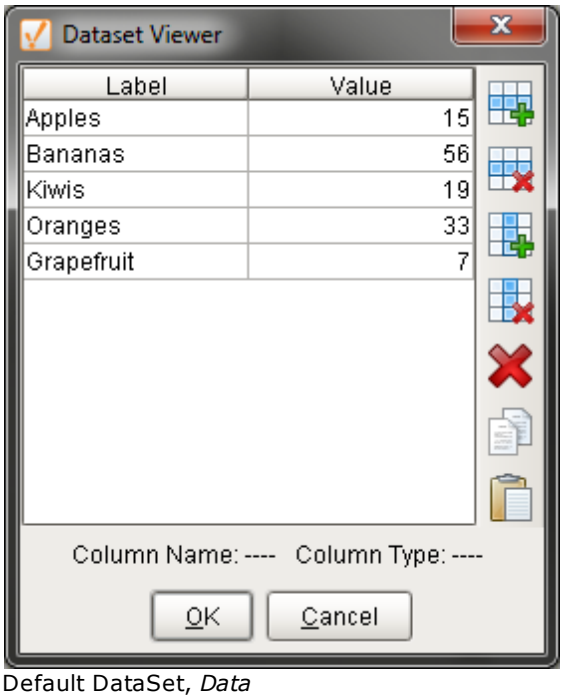

Default DataSet, *Data*

Here are the steps to creating the report:

1. Install Ignition Reporting Module
2. Drag *Report Viewer* from Reporting tab into project window
3. Open Report Designer by selecting *Report Viewer* and clicking on the **Customizer**.

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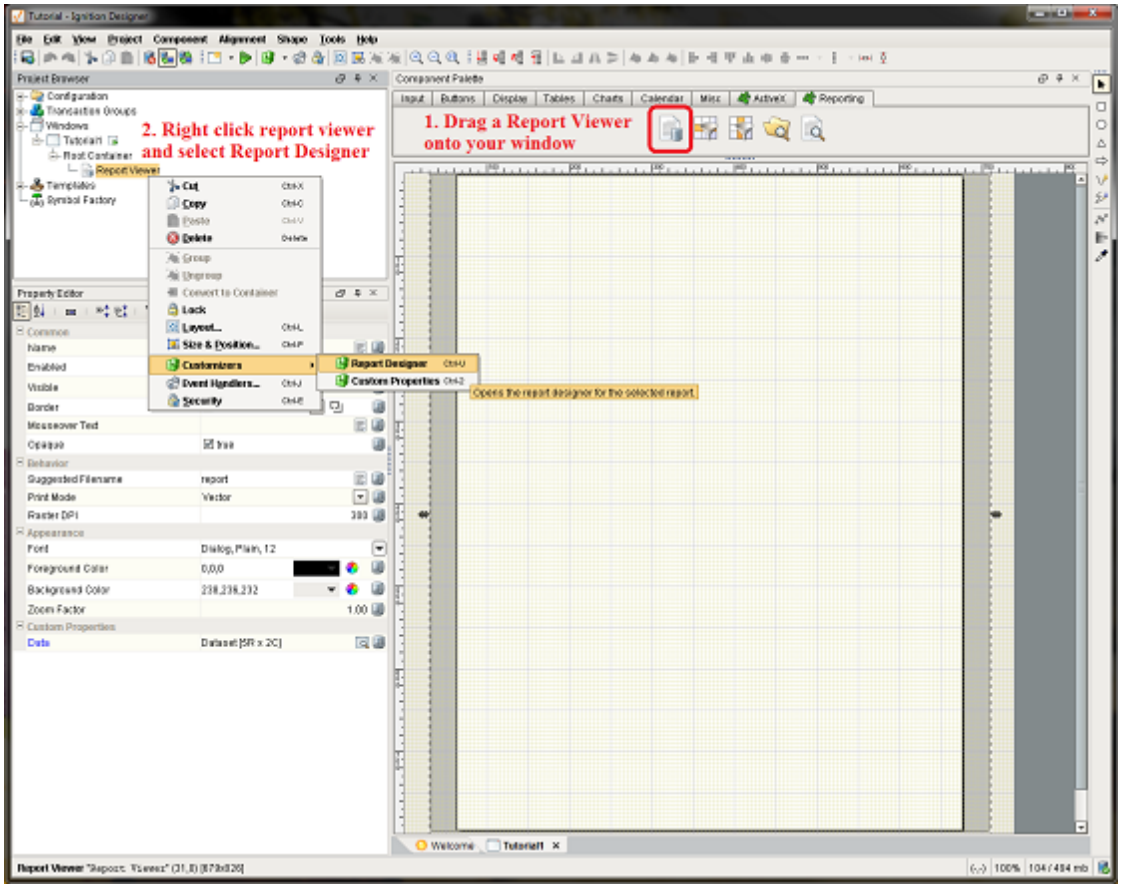
2. Right click report viewer and select Report Designer
1. Drag a Report Viewer onto your window
Report Designer
Custom Properties
Opens the report designer for the selected report

4. Select the keys tab of the Attributes panel and drag *Data* to the report.
5. Select **graph**
6. Click on the report to **unselect** the graph. Drag *Data* again, this time select **table**
   .

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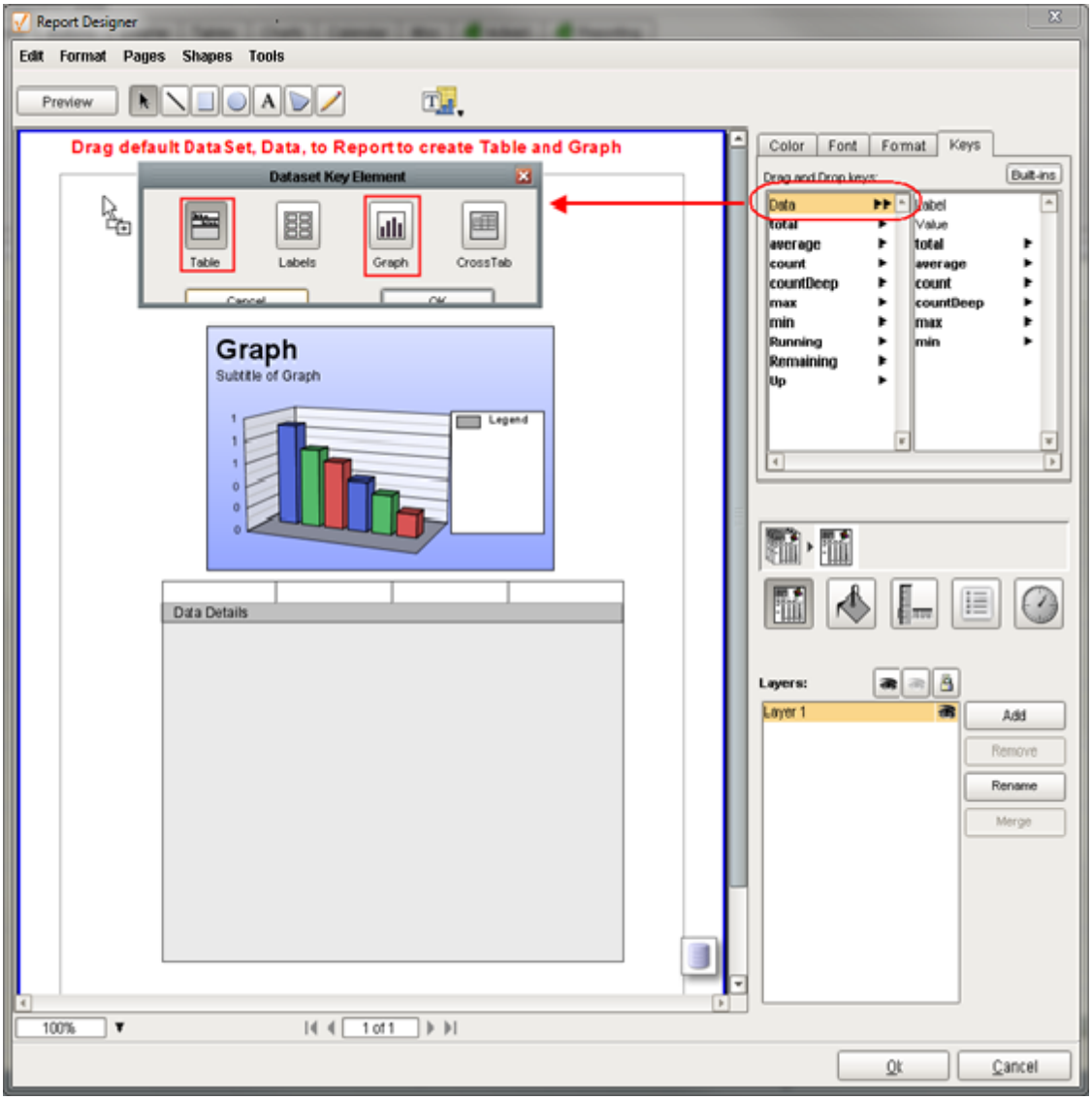

7. Drag *Value* key down to "Keys:" or type **Value**
8. Keep double-clicking until you select "Legend" then type **@Label@** or drag the Label key in.

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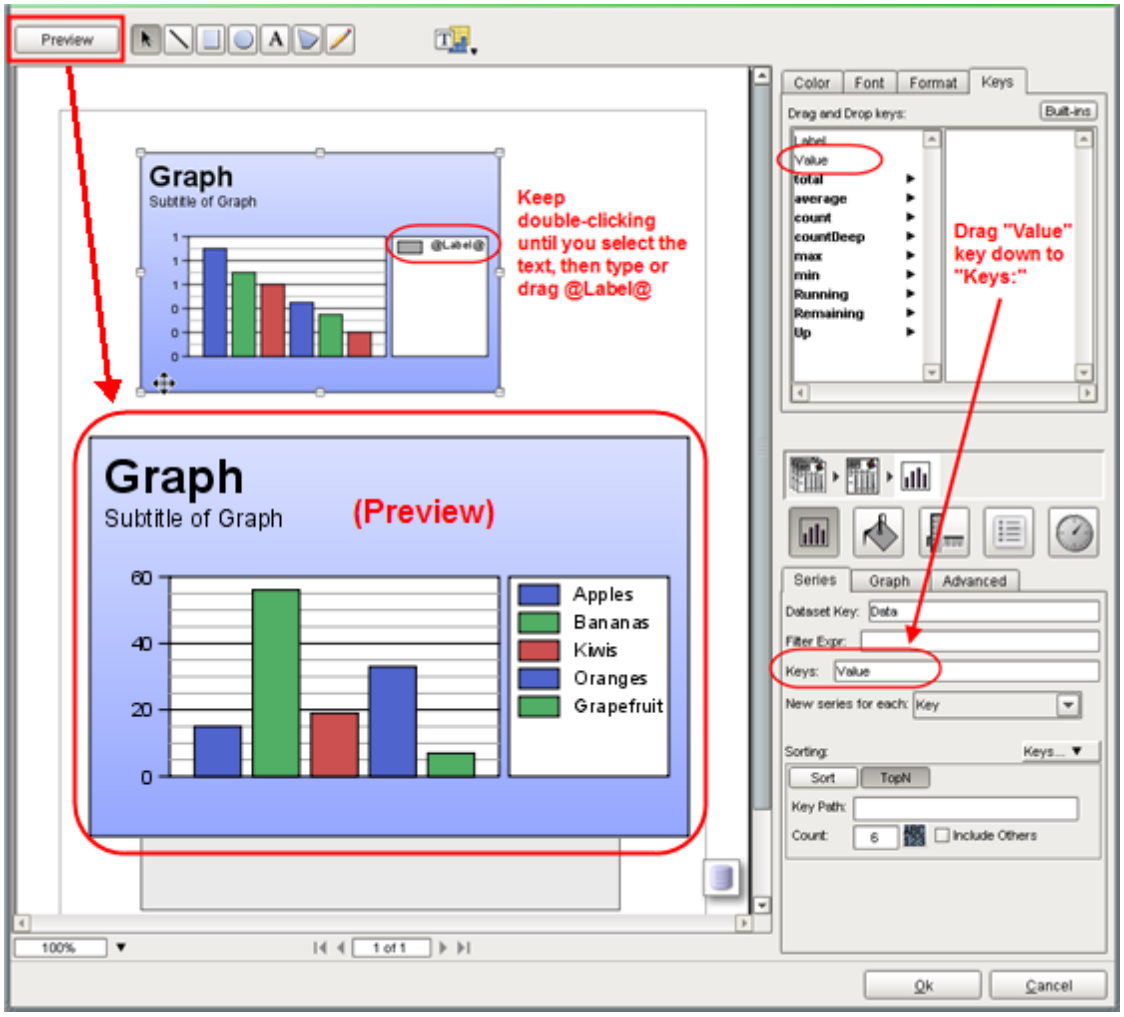

9. On the *Graph* tab of the Inspector Panel, select the pie chart icon .
10. Drag colors from the Color Attribute Panel to the graph's series colors.
11. Superselect the graph shape and resize the graph and legend.

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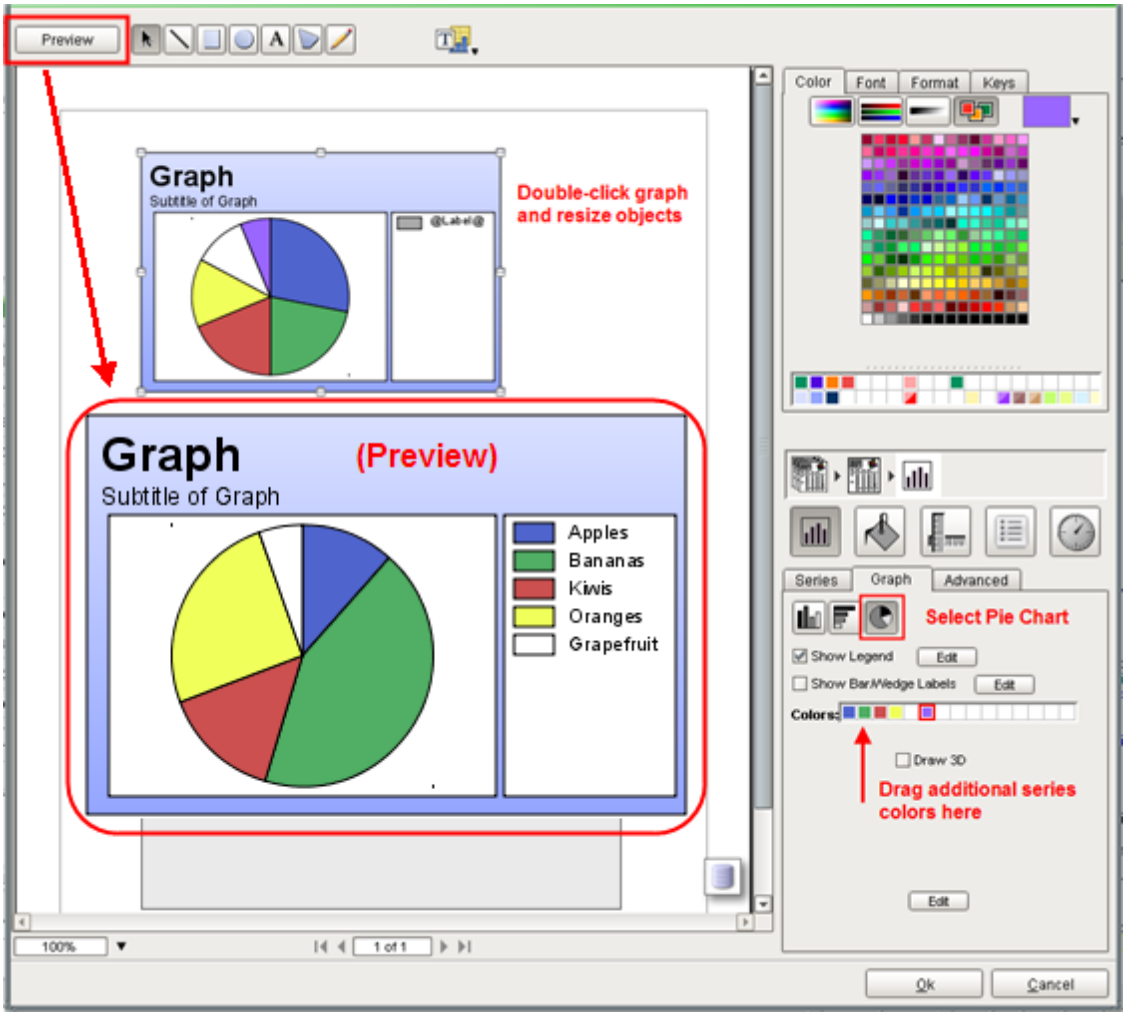

12. On the *Graph* tab, check *Show Bar/Wedge Labels*.
13. Superselect the label text. Change the font size to 12 point.
14. Change the text to "**@Value@** (@100 * Value / total.Value@%)". We're intermingling static text and substitution keys to display both the value and percentage.
15. Select **@Value@** text and type Cntl+B to make it **bold**.

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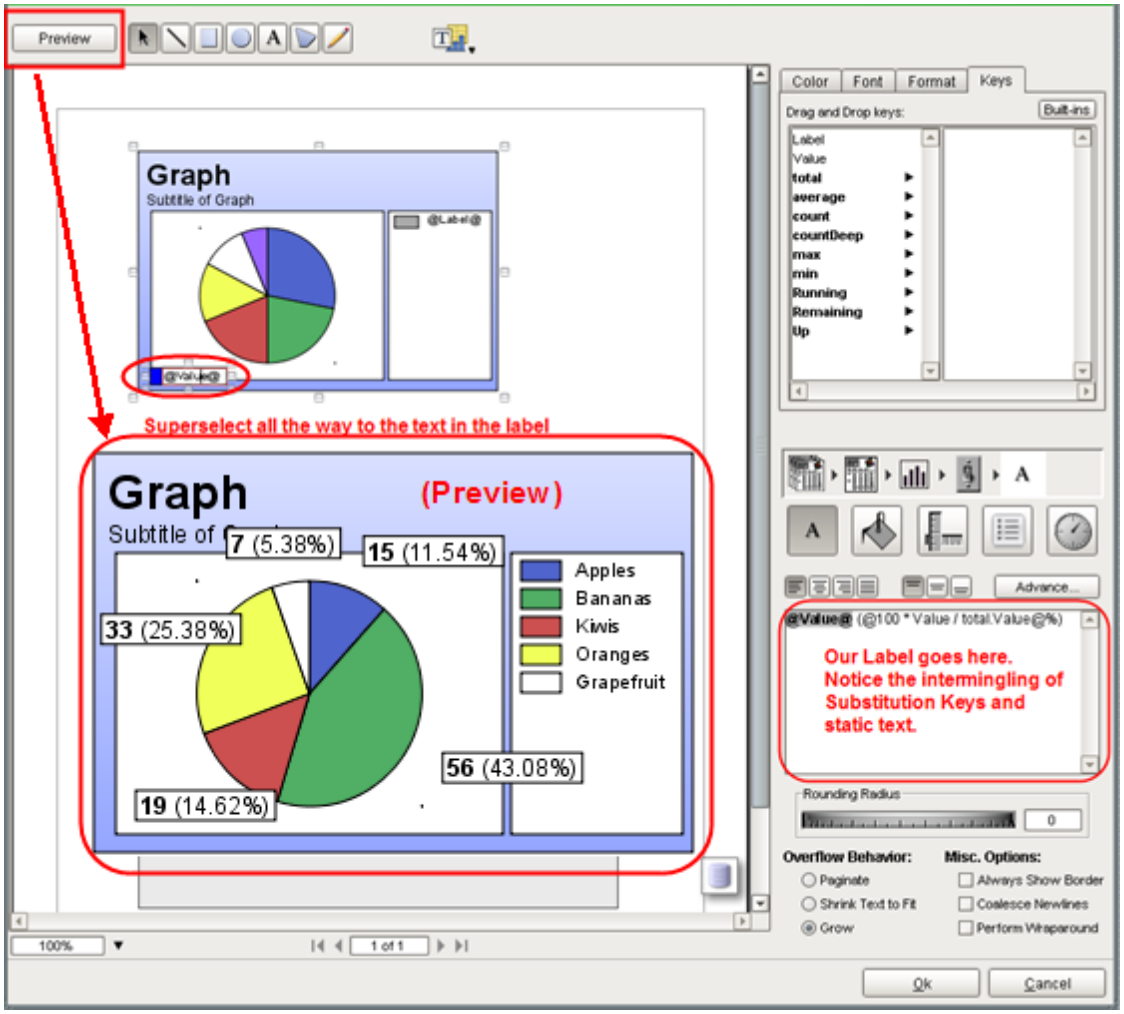

16. Select Table and check **Header**
17. Drag extra column off workspace to get rid of it. This can also be done in the table inspector.
18. Type in headers. In this case we made the text **bold** and centered.
19. Drag key columns to *Data Details* columns.
20. For percentage, we use "@Value / Up.total.Value * 100@%" or "@Value / Data.total.Value * 100@%"
21. Drag Value key to **Sorting:**. Click descending sort .

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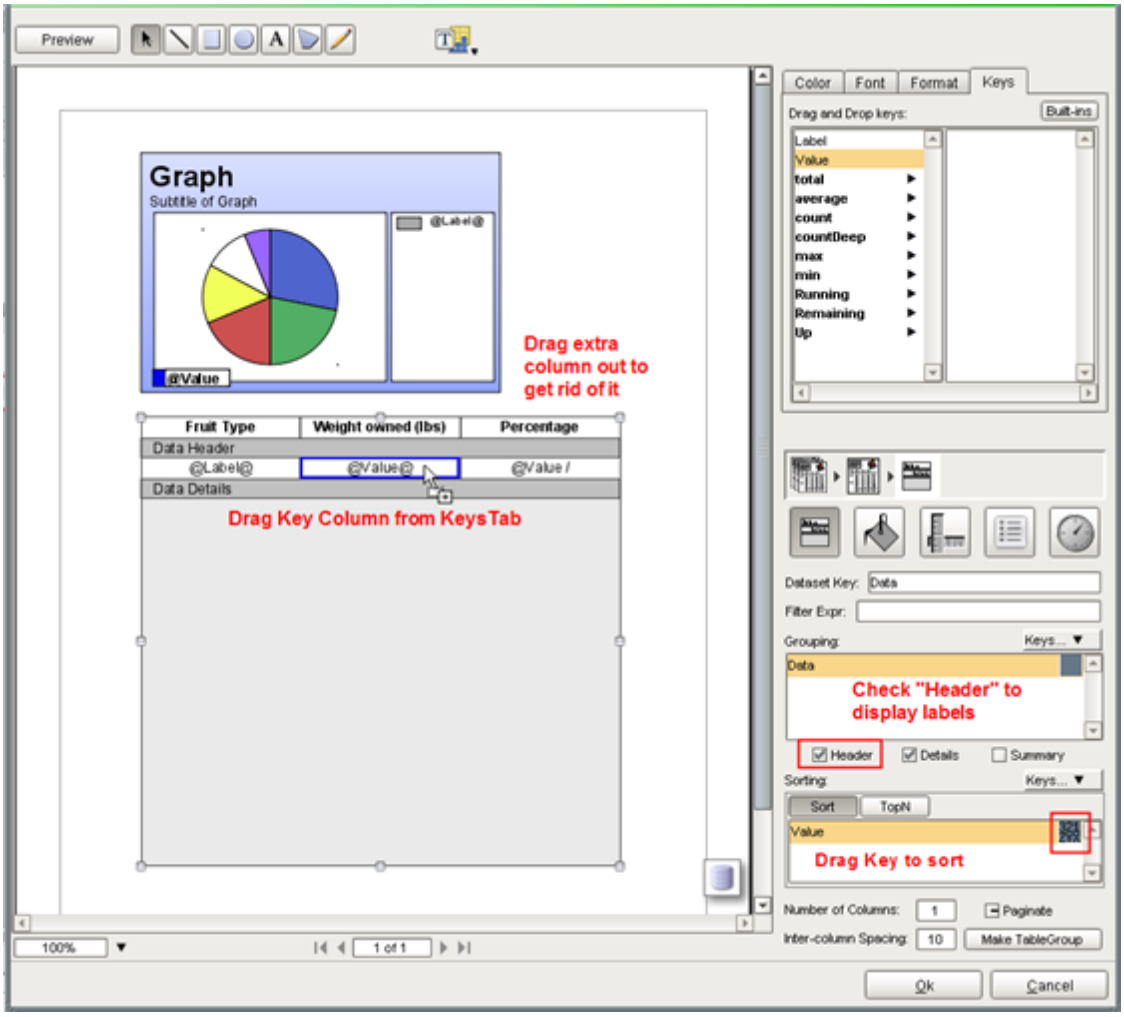

22. Resize the graph and modify the label
23. Double-click the graph, click to add Alternate Row Version
24. Click **Standard** on **Data Details**, select *Alternate*
25. Change the row fill color to gray.
26. Do the same for the *Data Header* **fill color** with a darker gray.
27. Select the graph and add a border (stroke) in the **Stroke** tab.

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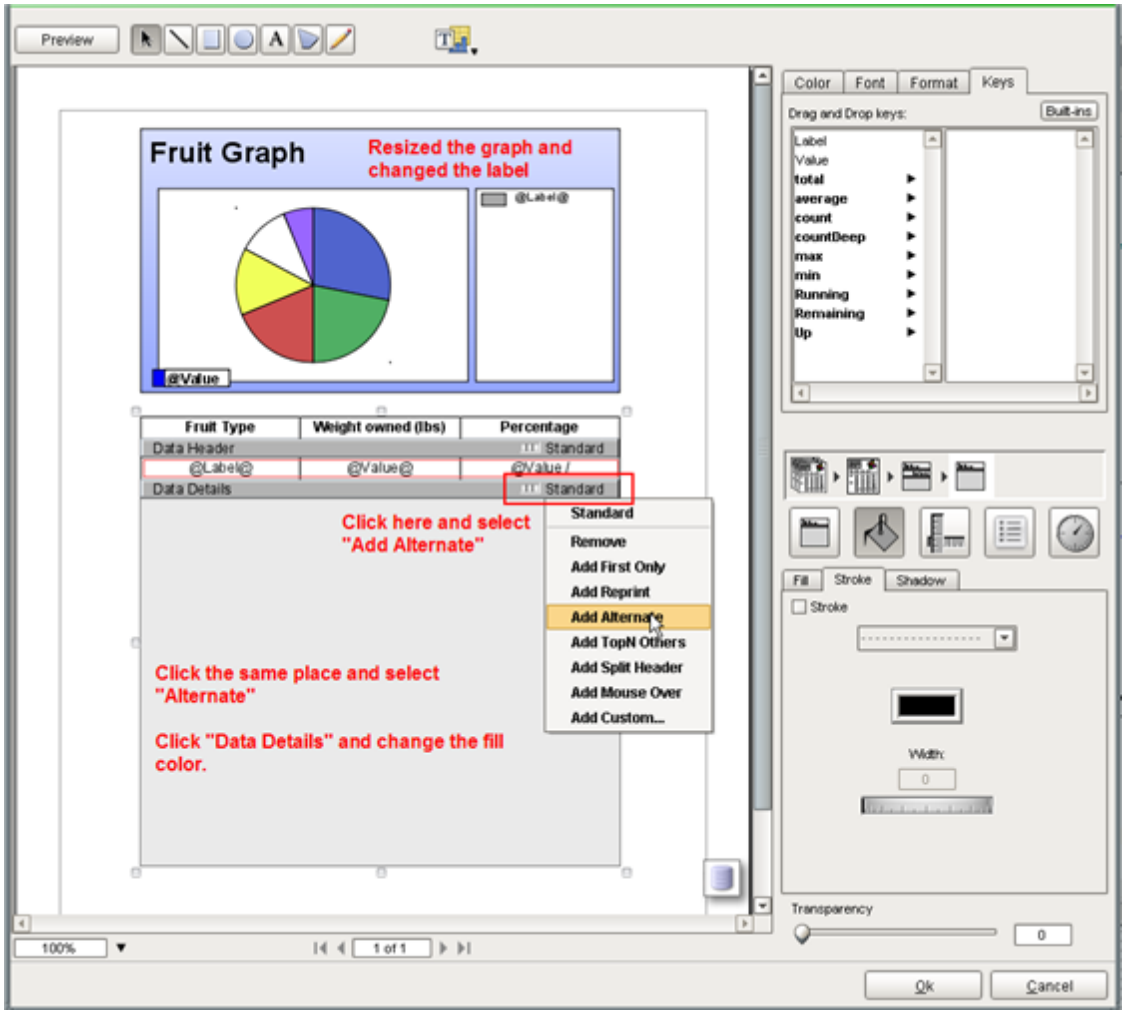

28. Drag in a gradient filled rectangle, text and the included image *Bultin/icons/48/check2.png* to create our header

29. From the **Keys** tab, click **Built-ins** and drag down page numbers.

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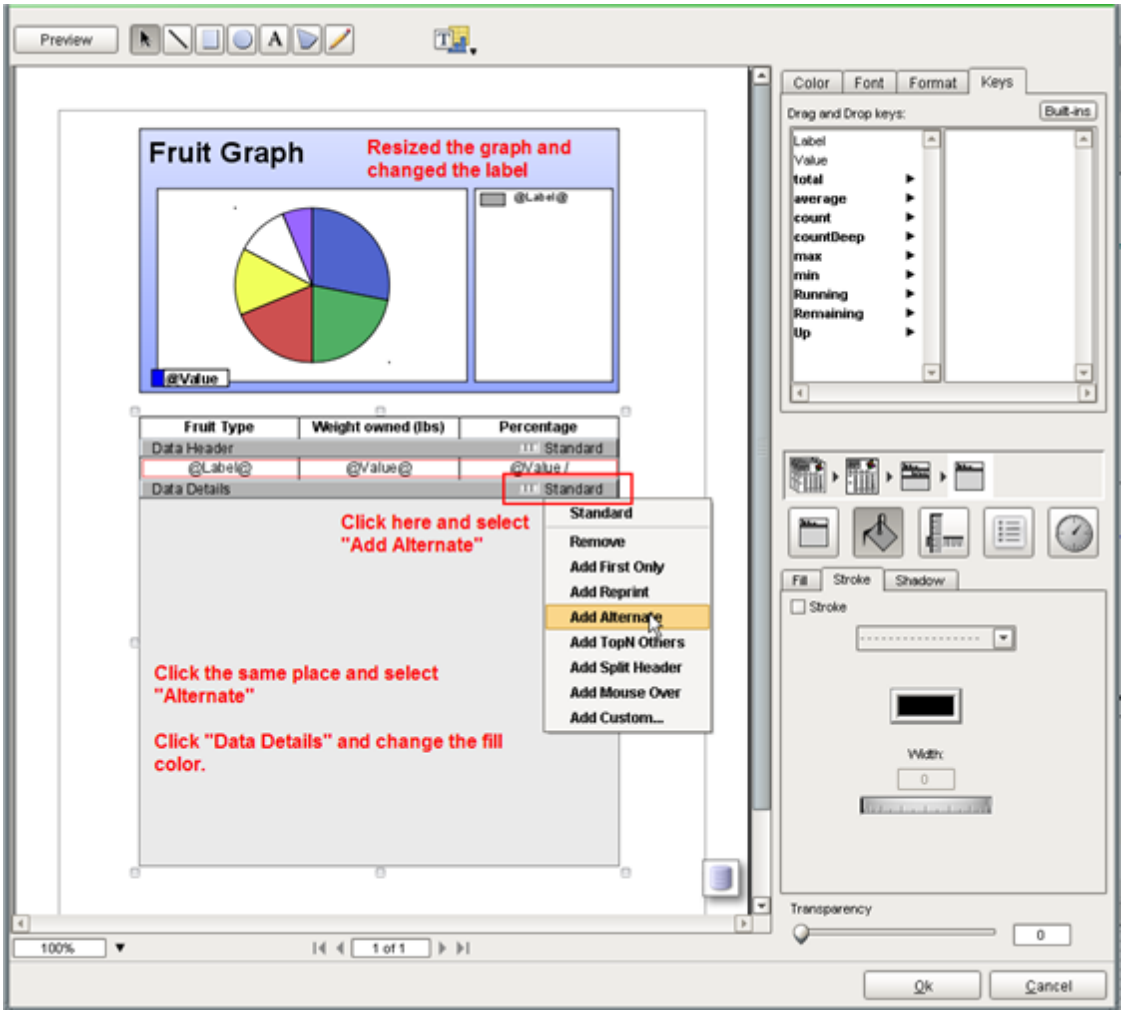

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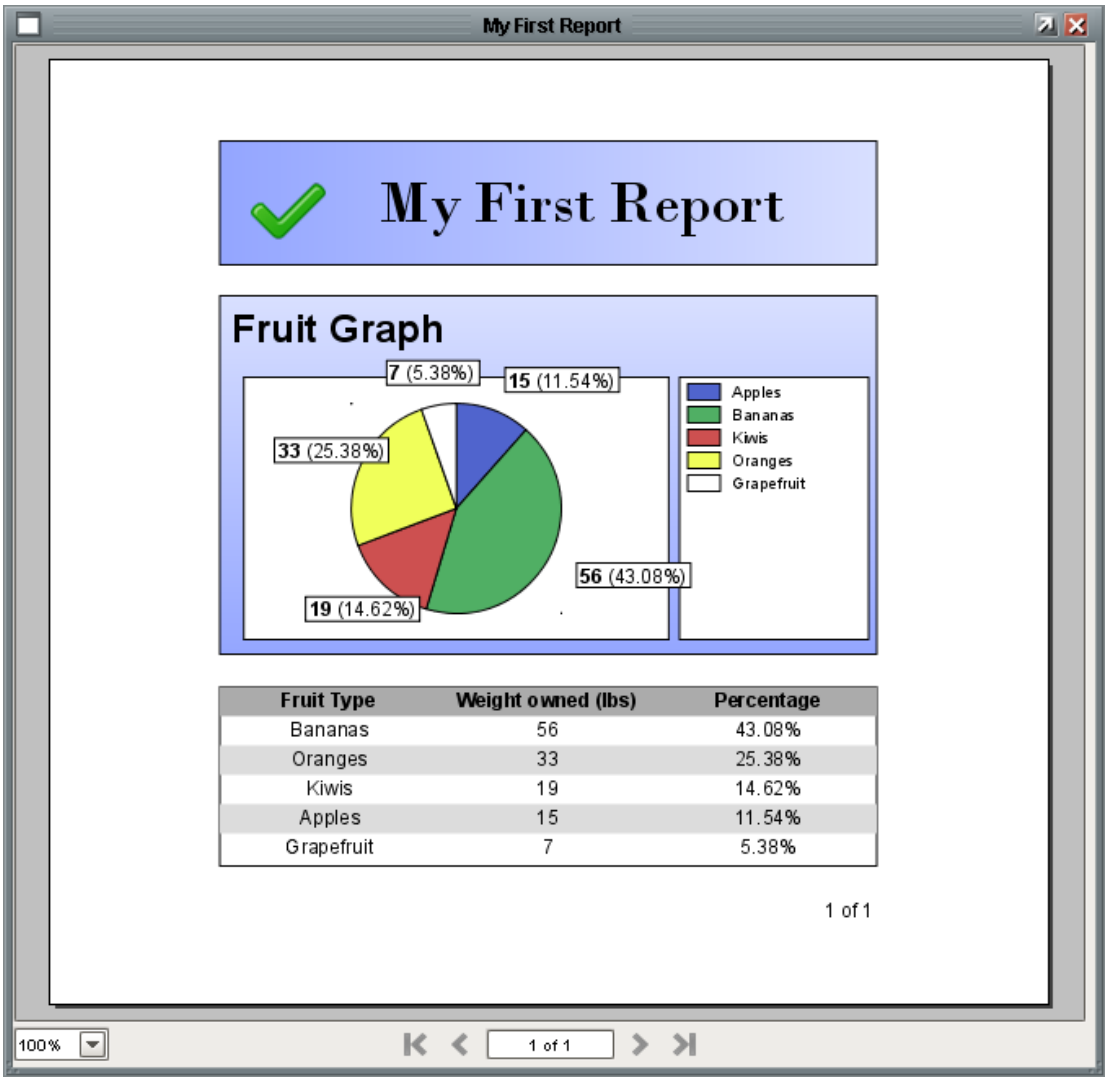

Our finished first report

5.8.2 Tutorials

Tutorial #1 takes you through a Widget Co. quarterly employee vacation report. It should give you an idea on how to make a table based report and provide examples of common reporting features. Check out Tutorial 2 for an example of more features.

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WIDGET CO.

EMPLOYEE VACATION REPORT
Prepared: August 18, 2006

SALES

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Michael	Bolton	12/01/04	29000	35	$4,229
Robert	Hill	05/02/04	35000	27	$3,937
Jeffrey	York	02/15/06	69000	18	$5,175
Andrea	Sanchez	01/01/06	73000	16	$4,867
Elaine	Short	05/05/06	32000	5	$667
Thomas	Jones	09/15/06	115000	4	$1,917

SALES department Total: $20,792

ADMIN

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Joe	Blogs	05/13/02	46000	22	$4,217
Edward	Oscar	12/31/05	61000	3	$762
Brian	Green	03/15/04	55000	1	$229

ADMIN department Total: $5,208

ENGINEERING

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Chris	McDade	07/01/06	52000	31	$6,717
Julia	Hinderson	01/01/05	121000	19	$9,579
Tim	Moore	12/15/05	73000	10	$3,042
Adam	Blackwell	02/05/04	96000	6	$2,400

ENGINEERING department Total: $21,738

Grand Total: $47,738

Page 1 of 1

WIDGET CO
1 Widget Lane
City, State, 12345

Tel: (800) 123-4567
Fax: (800) 123-4568

Other offices
Sacramento, CA
Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI

www.website.com

[Background]

[Getting Started]

[Basic Layout] including headers and footers

[Substitution Keys and Tables] including grouping and sorting

[Row Versioning] and final touches

[Next (Background)]

TIP	Create your own report as you go through the tutorial.

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5.8.2. .2 Background

Widget Co. is concerned with maximizing the morale of its people. Every employee is entitled 3 days of paid vacation per month. Employees are given the option of selling back their vacation days at 1 1/2 times their normal wage.

The production manager has tasked you with creating a report with the following requirements:

Look **presentable** - The report will be going to the VP.

automatically display generation date and page numbers. This needs to be a "one click" report.

Group employees by department.

Be **dynamic** - Widget Co. anticipates rapid growth. The report needs to be able to deal with a large number of employees, possible new departments, and separate pages automatically without cutting off data.

Calculate equations automatically - The manager is interesting in knowing how much money in vacation time each employee is owed, as well as a running total by department.

Sort employees by vacation days. Widget Co. gives preferential approval to the employee with the most days.

Support **custom row versions**. A special paid vacation is offered when an employees vacation sellback value exceeds $5000. Such employees need to stand out!

Employee data can be retrieved from the accounting database with the following SQL query:

```
SELECT * FROM employees;
```

	first	last	department	lastSell	income	withholdings	vacationdays
1	Joe	Blogs	ADMIN	2002-05-13 00:00:00	46000	5000	22
2	Julia	Hinders...	ENGINEERING	2005-01-01 00:00:00	121000	10000	19
3	Adam	Blackwell	ENGINEERING	2004-02-05 00:00:00	96000	8000	6
4	Robert	Hill	SALES	2004-05-02 00:00:00	35000	200	27
5	Brian	Green	ADMIN	2004-03-15 00:00:00	55000	4000	1
6	Elaine	Short	SALES	2006-05-05 00:00:00	32000	2000	5
7	Tim	Moore	ENGINEERING	2005-12-15 00:00:00	73000	4000	10
8	Chris	McDade	ENGINEERING	2006-07-01 00:00:00	52000	4000	31
9	Andrea	Sanchez	SALES	2006-01-01 00:00:00	73000	5000	16
10	Thomas	Jones	SALES	2006-09-15 00:00:00	115000	12000	4
11	Jefffrey	York	SALES	2006-02-15 00:00:00	69000	1000	18
12	Michael	Bolton	SALES	2004-12-01 00:00:00	29000	500	35
13	Edward	Oscar	ADMIN	2005-12-31 00:00:00	61000	3000	3

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We will modify our SQL query to include the derived value **buyout**, the monetary value of employee's vacation days.

CAST is used so that MySQL returns **buyout** as a number instead of a string.

```
SELECT *, CAST(income/360 * 1.5 * vacationdays AS SIGNED) AS buyout FROM employees;
```

	first	last	department	lastSell	income	withholdings	vacationdays	buyout
1	Joe	Blogs	ADMIN	2002-05-13 00:00:00	46000	5000	22	4217
2	Julia	Hinderson	ENGINEERING	2005-01-01 00:00:00	121000	10000	19	9579
3	Adam	Blackwell	ENGINEERING	2004-02-05 00:00:00	96000	8000	6	2400
4	Robert	Hill	SALES	2004-05-02 00:00:00	35000	200	27	3937
5	Brian	Green	ADMIN	2004-03-15 00:00:00	55000	4000	1	229
6	Elaine	Short	SALES	2006-05-05 00:00:00	32000	2000	5	667
7	Tim	Moore	ENGINEERING	2005-12-15 00:00:00	73000	4000	10	3042
8	Chris	McDade	ENGINEERING	2006-07-01 00:00:00	52000	4000	31	6717
9	Andrea	Sanchez	SALES	2006-01-01 00:00:00	73000	5000	16	4867
10	Thomas	Jones	SALES	2006-09-15 00:00:00	115000	12000	4	1917
11	Jeffrey	York	SALES	2006-02-15 00:00:00	69000	1000	18	5175
12	Michael	Bolton	SALES	2004-12-01 00:00:00	29000	500	35	4229
13	Edward	Oscar	ADMIN	2005-12-31 00:00:00	61000	3000	3	762

Previous (Index) Next (Getting Started)

TIP

We could use expressions within the report to calculate **buyout**. In this tutorial we use the SQL database because we will be using **buyout** in many places. We will: display it as a column, use it as the basis of our custom row versions, and may want the option of sorting our report based on it. Other reasons include: leveraging the SQL database's rich function library and only needing to change the expression in one place.

5.8.2. .3 Getting Started

We begin by installing the Reporting module and creating a report in our project within the Ignition designer.

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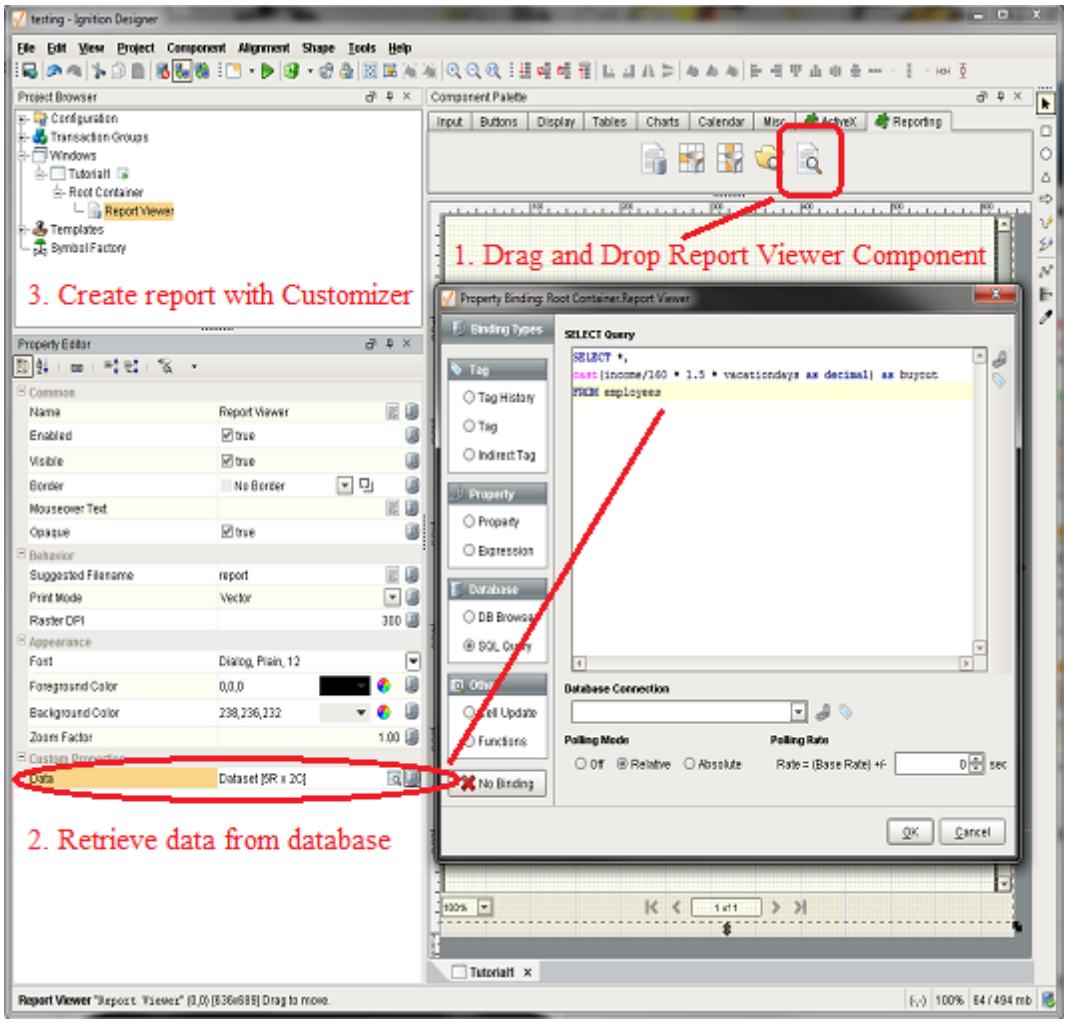

1. Install the Ignition Reporting Module
2. Create a new Window, and drag down a Report Viewer from the **Reporting** tab.
3. Populate the **Data** dynamic dataset. Note: You can customize your own Reporting datasets.
4. Select the Report Viewer component and click on the Customizer (Cntl+U). This is where you will be creating the report.

Index Previous (Background) Next (Basic Layout)

5.8.2. .4 Basic Layout

Clicking on the customizer with the Report Viewer opens the **Report Designer** window where we create our report.

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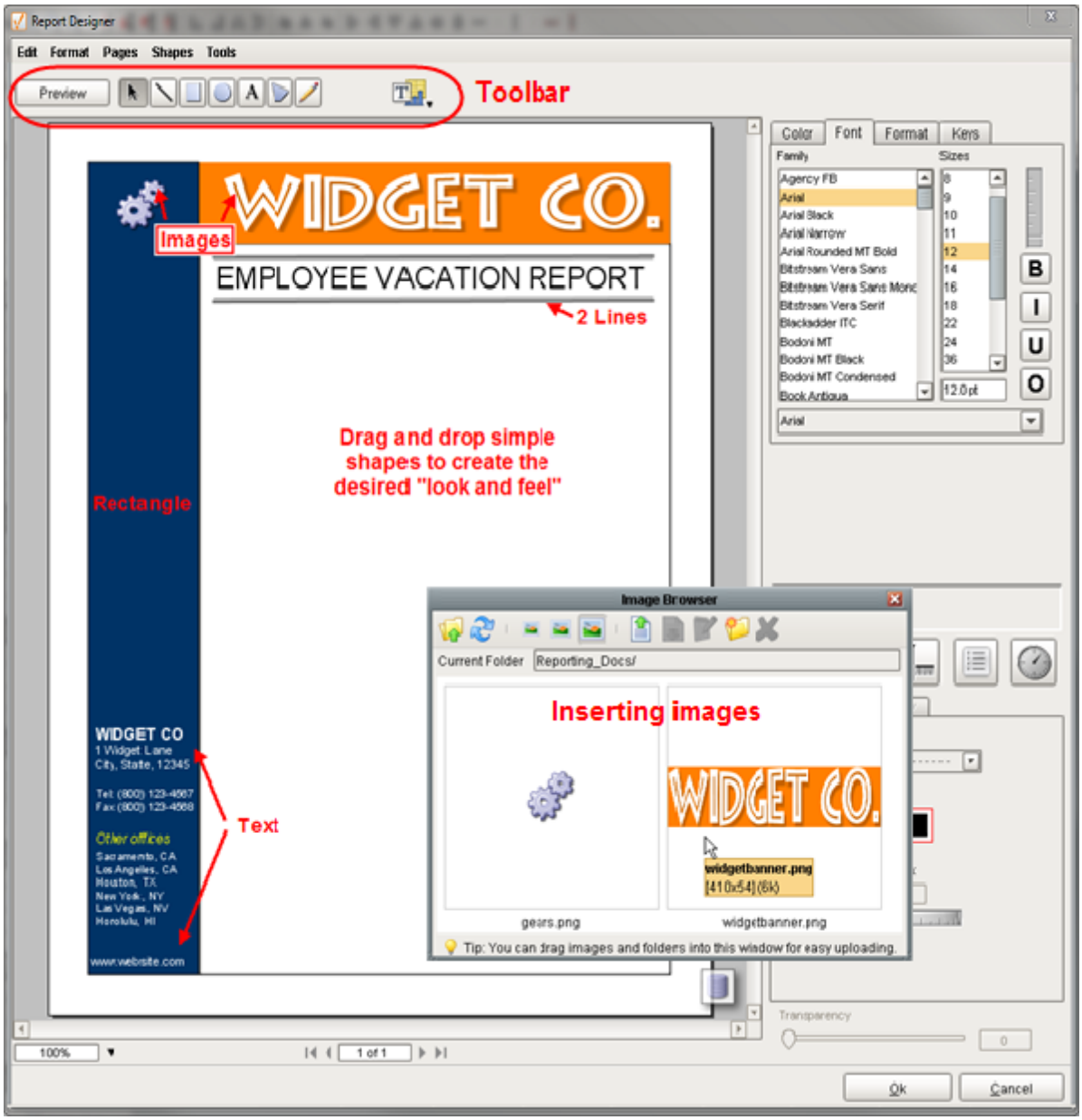

Everything here was created with the toolbar.The following steps were taken:

1. Drag the left and top rectangles. Modify their fill property in the attributes panel to create the blue and orange background colors.
2. Drag another border rectangle for good measure.
3. Add Shapes->Image. Repeat for gears and header image.
4. Add Text. Modify applicable properties in their inspector and attributes panels. Double clicking text for superselection is key here!
5. Add 4 Lines. Modify applicable properties in their inspector and attributes panels.

Index Previous (Getting Started) Next (Substitution Keys and Tables)

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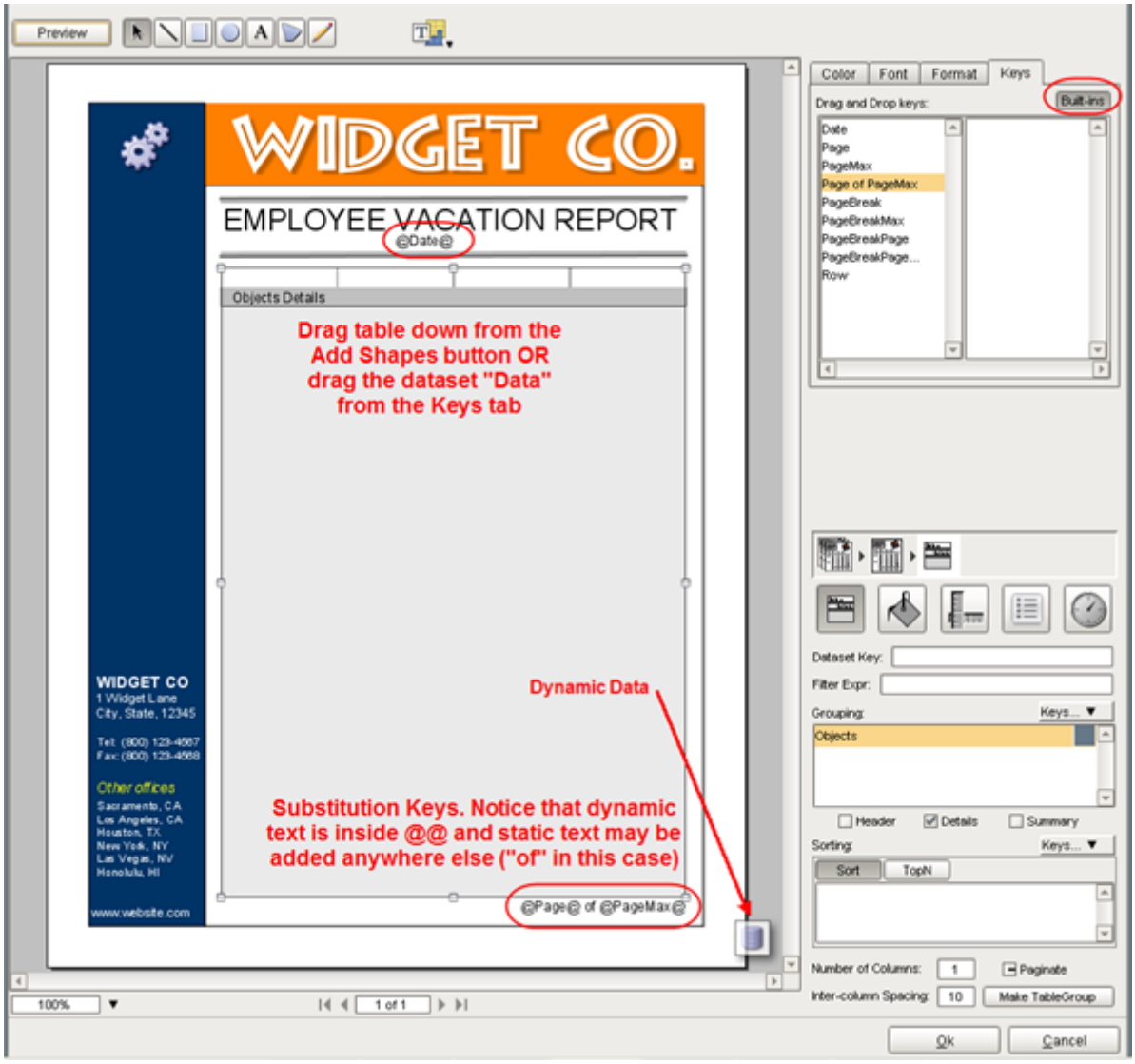
TIP	Borrow the look and feel from existing reports!

5.8.2. .5 Substitution Keys and Tables

The most interesting portion of this report will be a table. It will occupy as much space as the size that we drag it on the screen, creating extra pages as necessary for the data.



Adding Page Numbers

1. Select the keys tab, click the **Built-ins** button, then drag the *Date* key into the report header. The cursor will change to the *Drag Key* icon. Releasing the mouse button will place a label with the text "**@Date@**".

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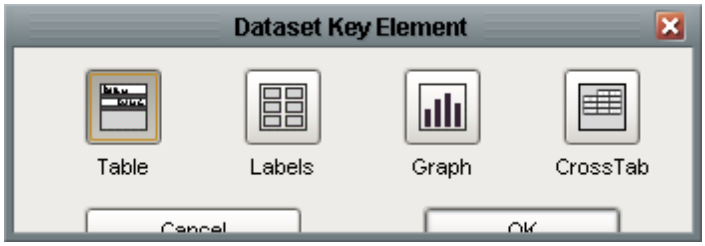
2. Repeat, dragging the builtin key "*Page @Page@ of @PageMax@*" to the footer (bottom) of the report.
3. Format the date by double clicking the text label to superselect the text, then use the formatter to format the date.

Creating Table



1. Drag the DataSet *Data* from the keys tab and choose table when you see the **Dataset Key Element** window above. Select **table** and click ok.

   Alternatively, create the table from the toolbar then drag down the *Data* key to the *Dataset key* field of the keys attribute panel. Defining the table's DataSet is done automatically when using the step above.
2. Resize and position the window as desired.

Table Customization

1. Select the table, and select to the Table Inspector panel. Clicking on the Shape Specific Inspector will bring up the same panel.
2. Select *Data* under grouping and check: Header, Details, and Summary. This creates a unique header and summary row for each unique department. **Data Details** refers to each employee.
3. Select *department* under grouping and check: Details, and Summary. **Summary** creates a single summary row for the report. **Details** at this level of grouping is just above as the **Data Header** level of *Data* (We could have used either one instead of both for this example). More on table row grouping precedence here.
4. Modify the structured column width property for each row. This defines how many columns, of a fixed user definable width, a given table row will use. We will use 6 columns for **Data Details**, and not use structured columns for the others. Not using structured column width can be set by unchecking the top checkbox shown below or by de-selecting the row's prison icon when the table is superselected .

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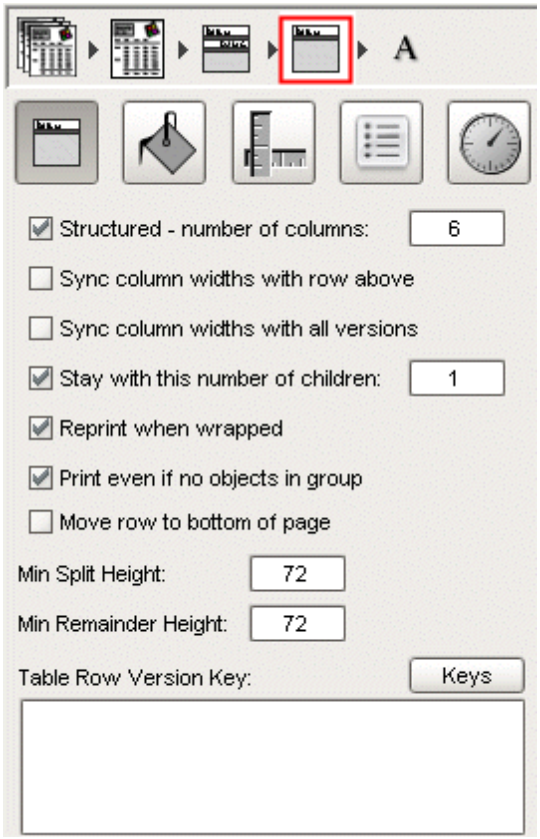

Superselect table, then single click select row to pull up this inspector

5. Drag keys into table row columns. See the six columns in the **Data Details** row of the screenshot below. Notice the use of text editing, and text formatting.

   The **total** aggregate key, @total.buyout@, is used for both departmental subtotals and the grand total. The difference lies in the level of grouping it is placed in and is explained here.

Sorting and Grouping

1. From the keys attribute panel, double click to drill down **Data**, then drag down **department** to the *grouping* field. This will automatically group our table by the **department** key. Each unique value of department will be represented by a separate table with the employees from that department.
2. From the keys attribute panel, drag down **vacationdays** to the *sorting* field then click the sort icon from ascending ABC 123 to descending 321 ZYX. This sorts our employees by vacation days from most to least.

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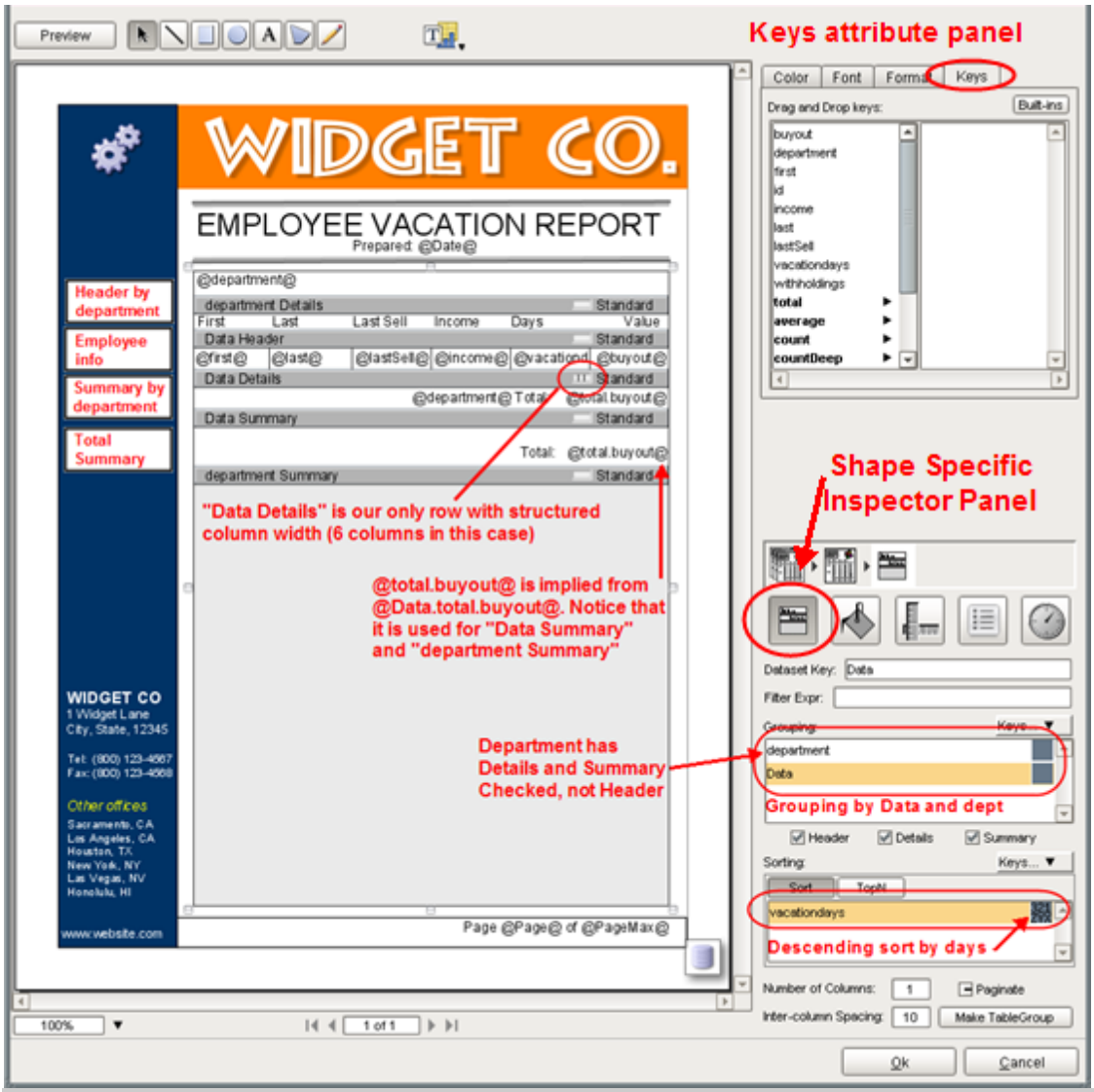

Preview

1. Click the preview button Preview to view your report.

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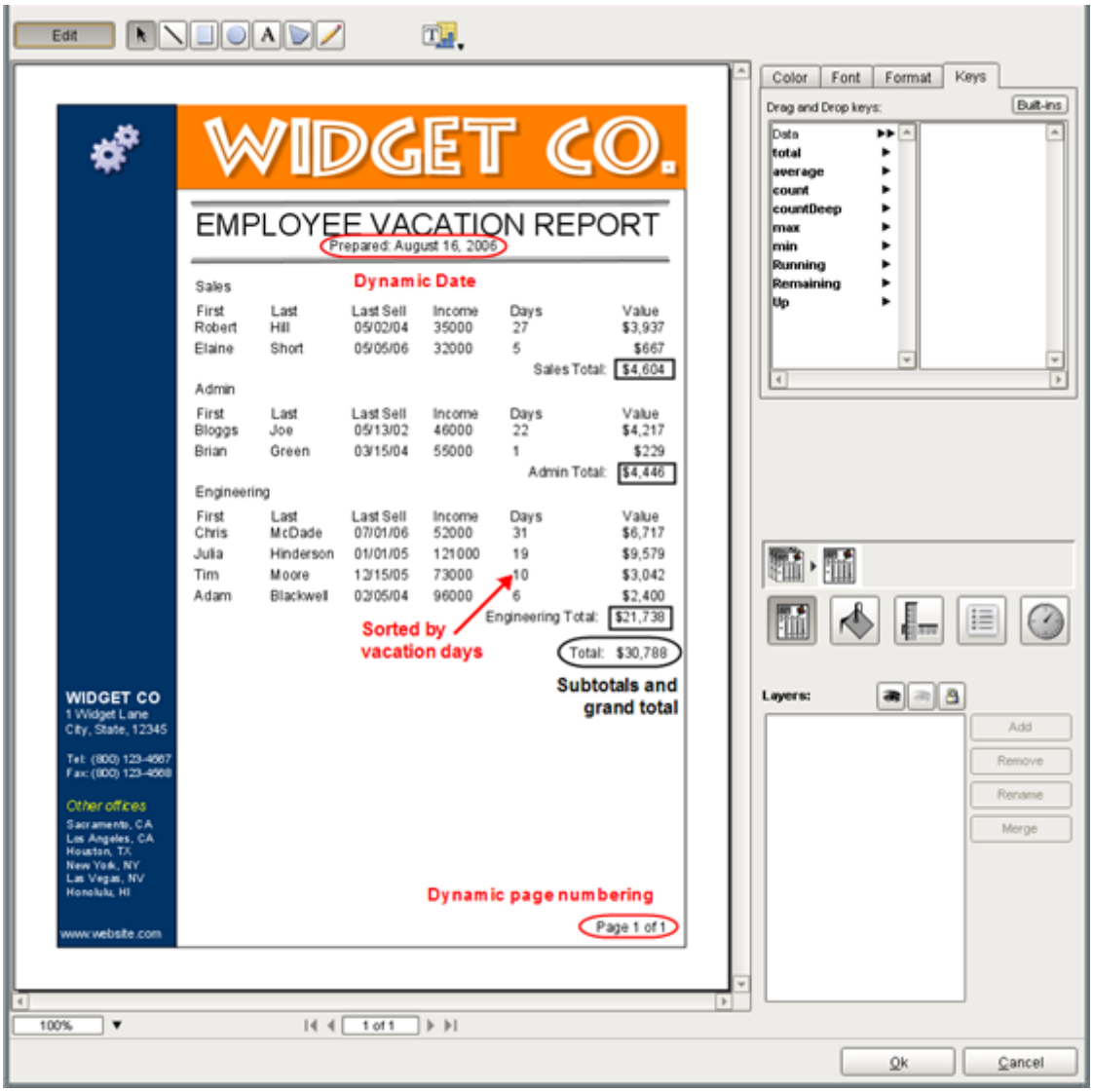

Index Previous Next (Row Versioning)

TIP	Don't be afraid to play with these options! It is much easier than it looks!

5.8.2. .6 Row Versioning

Now we want to color in the rows, and create different row versions for those employees that are entitled more than $5000.

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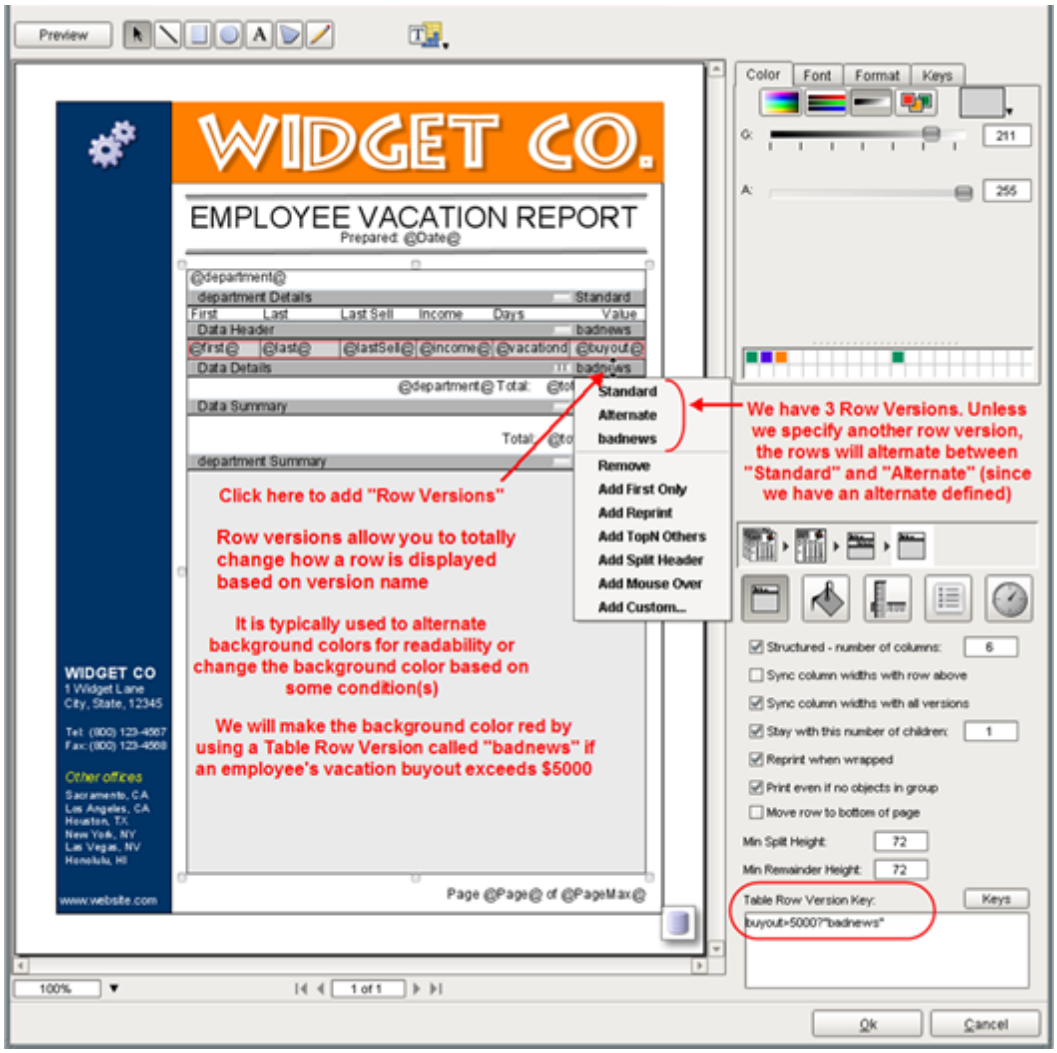

Here were the steps for this report

1. We begin by customizing the *Standard* Row Version, created by default for header, details, and summary. Click **Data Details** to select the row and use the fill/stroke inspector to add a background color (fill) and border (stroke). Resize columns and try to make all adjustments now as duplicate rows will be based on this one.
2. Click on the Row Version Label (Where the image shows **Click here to add "Row Versions"**) and click "Add Alternate".
3. Customize *Alternate* rows. In this case our only change was to darken the background color.
4. Click on the Row Version Label (Where the image shows **Click here to add "Row Versions"**) and click "Add Custom". Add *badnews*
5. Customize *badnews* rows. To illustrate flexibility, added borders to the individual key labels, changed background colors, and modified font properties including the bold property and text centering.

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6. Double click on the table then click on **Data Details** to select the **Data Details** row. Select the shape specific inspector property. Under **Table Row Version Key:** we enter:

```
buyout >5000?" badnews"
```

How it works: This conditional statement will return the string "badnews" if **buyout** exceeds $5000 for a given employee, changing the row version to *badnews* for that person. We intentionally don't specify an ELSE condition. Since a valid string is not returned, the report will default to using *Standard*, *Alternate*, or whatever builtin row versions are defined.

```
buyout >5000?" badnews" : " Al t er nat e"
```

Would make employees show up as our *Alternate* dark gray or *badnews* red. *Standard* would never be displayed. Note: Versions are different for each row, and they each have their own defining *Table Row Version Key*

7. Make final minor cosmetic changes

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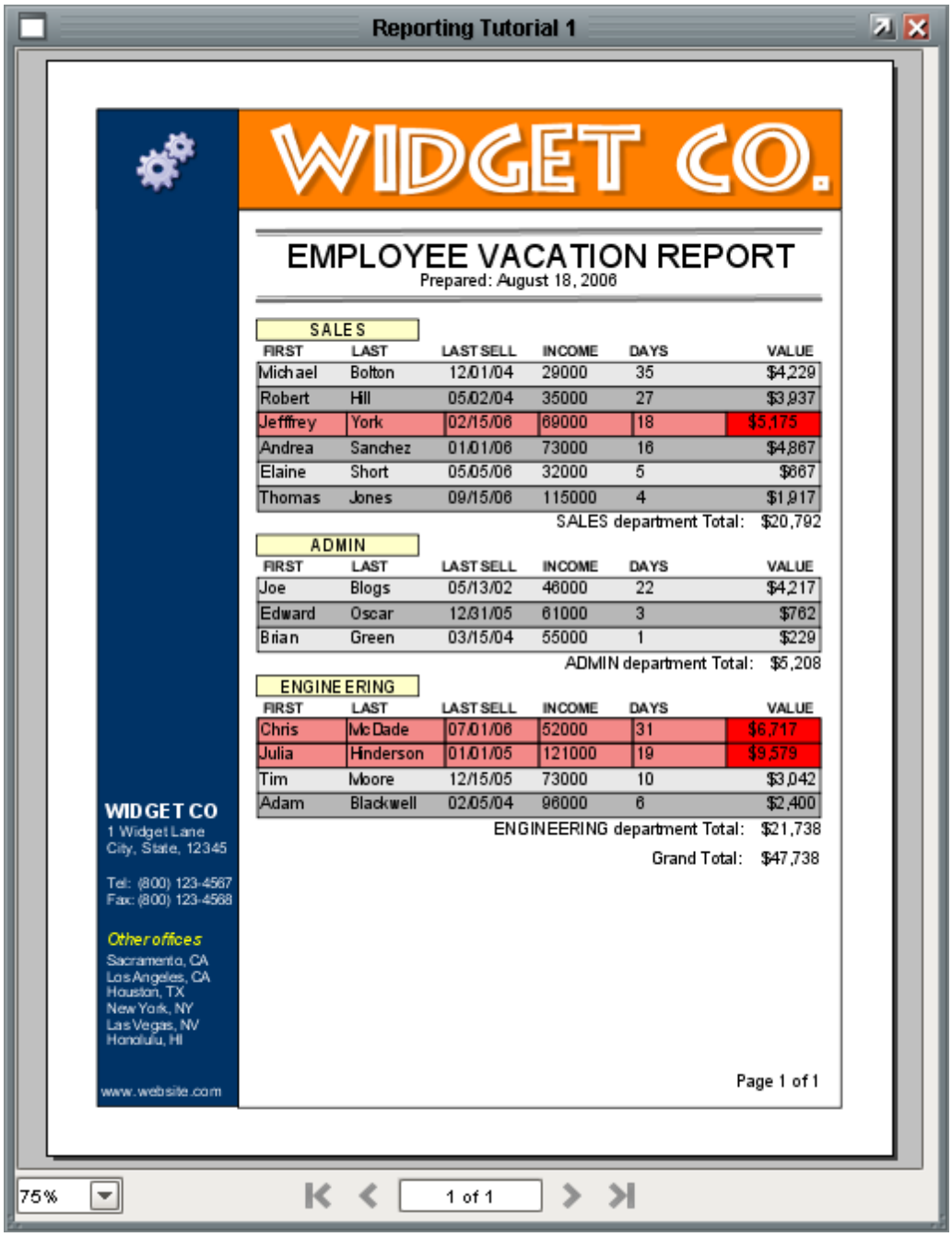

Done for now!

Index Previous (Substitution Keys) On to Tutorial 2

TIP	Borrow the look and feel of an existing report! This is much easier than it looks!

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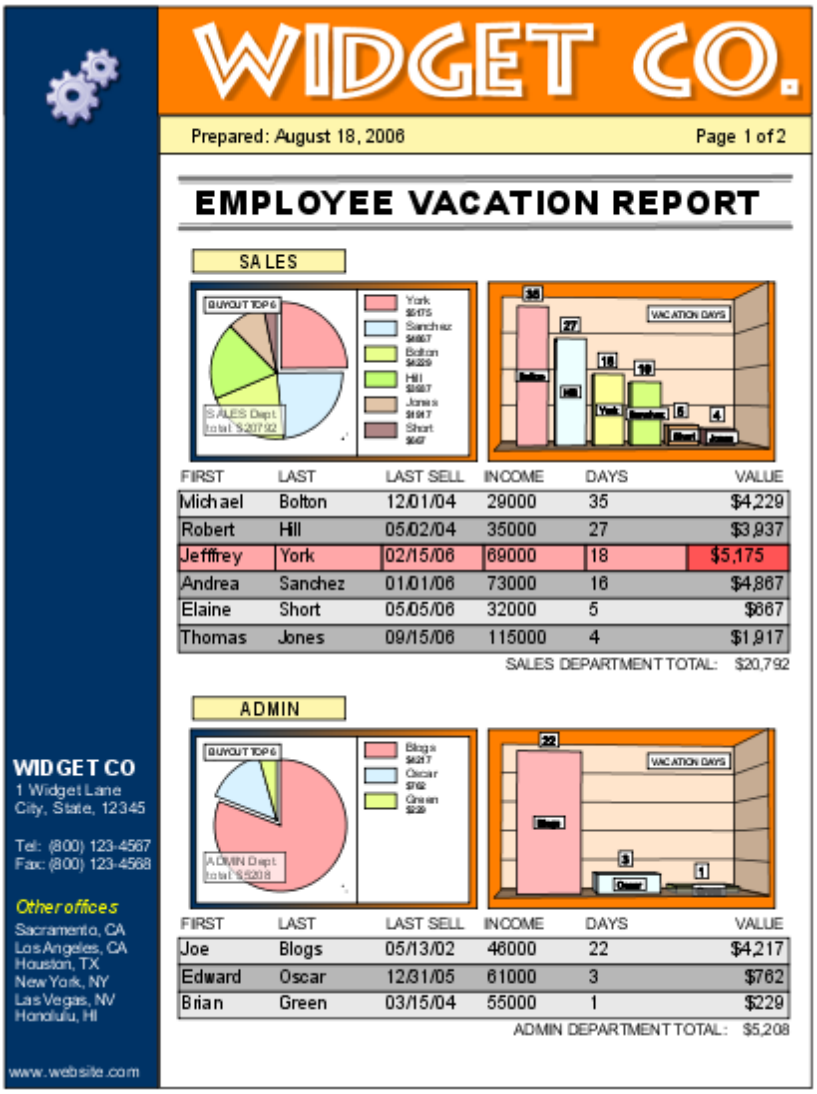
5.8.2.2 Tutorial #2 - Adding Graphs

Tutorial #2 adds dynamic graphs to the Widget Co. quarterly employee vacation report in Tutorial 1. We will make changes to the main table, have a unique header for the first page, and create a report summary for all employees. We will also add an extra dataset, polling data from two datasources.



We add dynamic graphs to the report.

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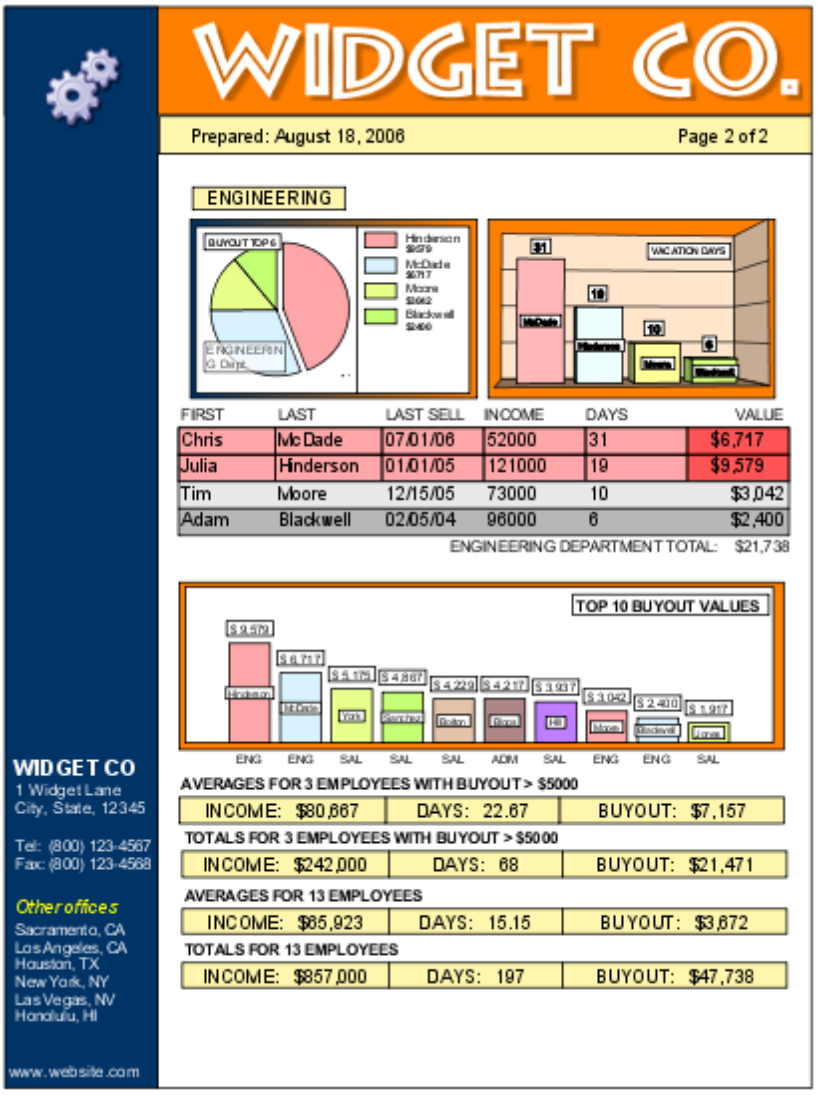
WIDGET CO.
Prepared: August 18, 2006
Page 2 of 2
ENGINEERING
BUYOUT TOP 6
VACATION DAYS
FIRST LAST LAST SELL INCOME DAYS VALUE
Chris McDade 07/01/06 52000 31 $6,717
Julia Hinderson 01/01/05 121000 19 $9,579
Tim Moore 12/15/05 73000 10 $3,042
Adam Blackwell 02/05/04 96000 6 $2,400
ENGINEERING DEPARTMENT TOTAL: $21,738
TOP 10 BUYOUT VALUES
AVERAGES FOR 3 EMPLOYEES WITH BUYOUT > $5000
INCOME: $80,667 DAYS: 22.67 BUYOUT: $7,157
TOTALS FOR 3 EMPLOYEES WITH BUYOUT > $5000
INCOME: $242,000 DAYS: 68 BUYOUT: $21,471
AVERAGES FOR 13 EMPLOYEES
INCOME: $85,923 DAYS: 15.15 BUYOUT: $3,672
TOTALS FOR 13 EMPLOYEES
INCOME: $857,000 DAYS: 197 BUYOUT: $47,738
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1 Widget Lane
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Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI
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Notice that the **EMPLOYEE VACATION REPORT** label only exists on the first page. Every page in Tutorial 1 would display that label.

Background

Getting Started

Basic layout and summary

More changes

Graphs

Next (Background)

5.8.2.2.2 Background

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The Vice President of Widget Co. is so happy with his **EMPLOYEE VACATION REPORT** that he insists you be the only one to modify it. After much thought he has come up with additional changes that will make his analysis easier and more effective.

1. Only display the **EMPLOYEE VACATION REPORT** header on the first page. Do what you can to maximize page usage. You are instructed not to remove the blue border.
2. Add pie graphs that illustrate vacation buyout value by department to indicate monetary entitlement.
3. Add bar graphs that show the number of vacation days per employee by department.
4. Add a summary bar chart that shows buyout values of employees with the greatest value, indicating the value and department.
5. Calculate average and total: income level, vacation days, and buyout value for all employees.
6. Calculate average and total: income level, vacation days, and buyout value for all employees with a buyout value exceeding $5000.

Previous (Index) Next (Getting Started)

5.8.2.2.3 Getting Started

After going through the documentation, you've come up with the following strategy:

1. Displaying a header on one page can be done with the reprint Table Row Version. Easy! We used the same technique to create alternate row colors in Tutorial 1!
2. Pie graphs should be simple enough. They need to be grouped by department. We will embed them within our department grouping.
3. Bar graphs will be exactly like pie graphs.
4. The summary bar chart needs to be outside department grouping. You choose to put it in the table summary.
5. Averages and totals should be no problem with aggregate keys. These will be placed with the above graph.
6. The last requirement strikes you as tricky to calculate within the report. You realize that you're dealing with a subset of the employees based on a definable condition, but maintaining totals and averages over that subset looks ugly. Can it be done with assignment expressions? Yes, but why not leverage our SQL database?

   You can come up with a single simple query that will return all employees with a buyout value > $5000. The report will see two different DataSets and can easily perform aggregate functions (total, min/max, average) on either. An additional benefit is that if you need to change the requirements you need only change one

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query.

```
SELECT *, CAST(income/360 * 1.5 * vacationdays AS SIGNED) buyout
FROM employees WHERE (income/360 * 1.5 * vacationdays) > 5000 ;
```

	first	last	department	lastSell	income	withholdings	vacationdays	buyout
2	Julia	Hinderson	ENGINEERING	2005-01-01 00:00:00	121000	10000	19	9579
8	Chris	McDade	ENGINEERING	2006-07-01 00:00:00	52000	4000	31	6717
11	Jeffrey	York	SALES	2006-02-15 00:00:00	69000	1000	18	5175

Index Previous (Background) Next (Basic Layout)

TIP Get in the habit of utilizing the SQL database. It is easier to manipulate the data *before* the report gets it. This is especially true when you need to do joins or have other complex query requirements.

5.8.2.2.4 Basic Layout

We're going to make a few minor aesthetic changes to give us room for graphs in the report. We will use both bar and pie graphs to indicate how many vacation days and how much vacation buyout money employees are entitled to. These graphs provide managers with an accurate idea on where they stand at a quick glance.

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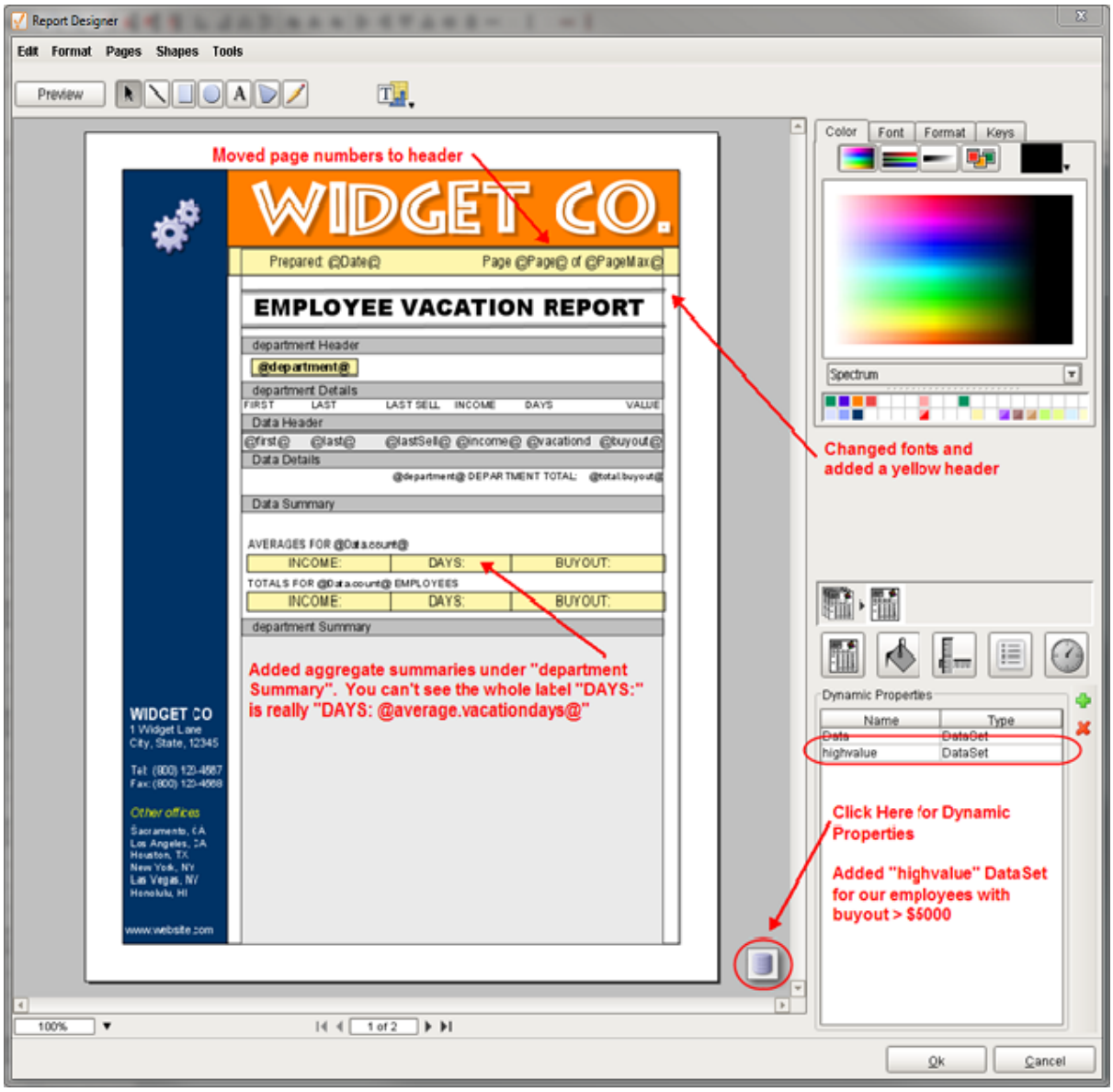

Almost everything here has been covered in Tutorial #1.

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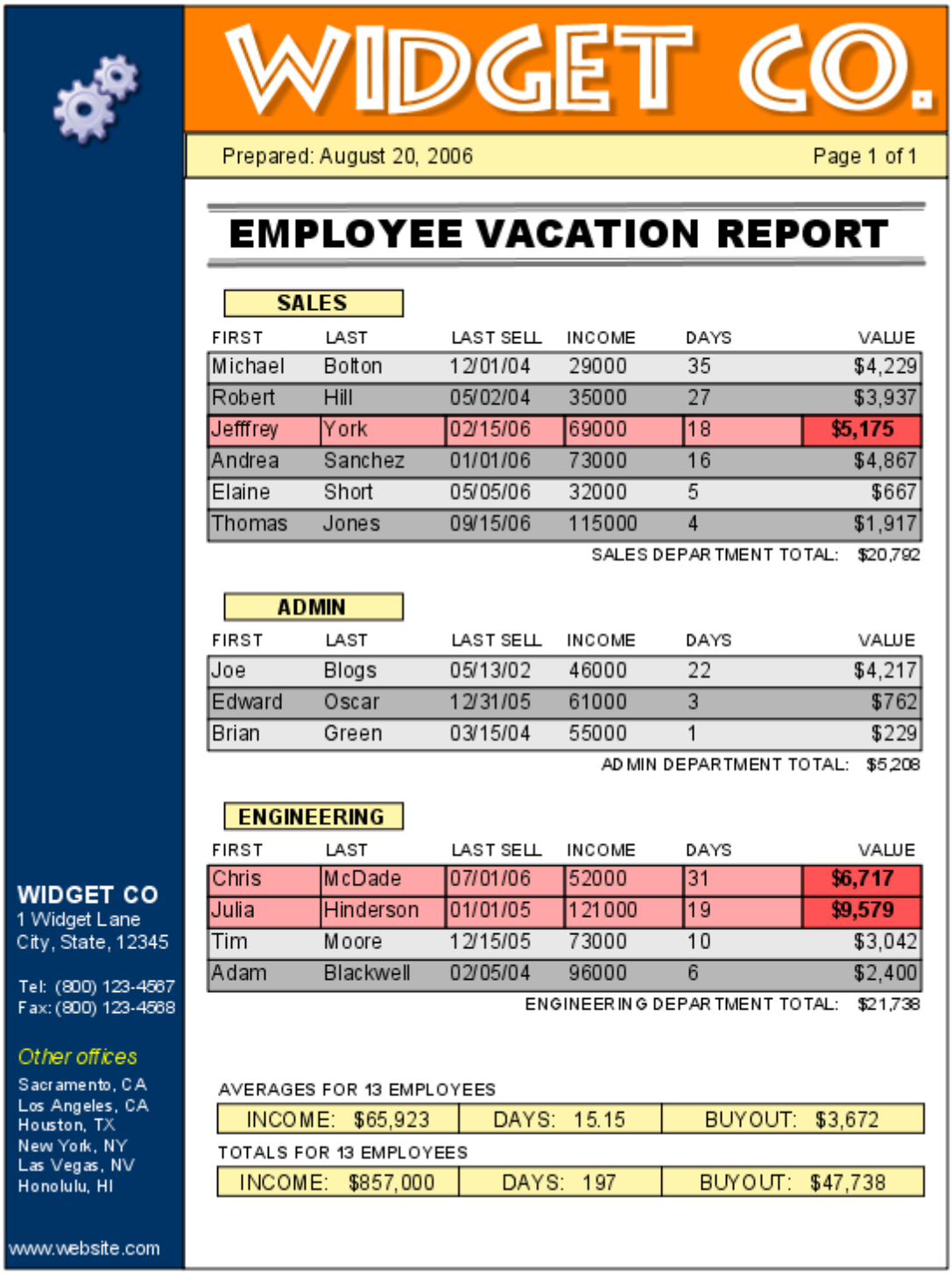

WIDGET CO.

Prepared: August 20, 2006 Page 1 of 1

EMPLOYEE VACATION REPORT

SALES

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
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SALES DEPARTMENT TOTAL: $20,792

ADMIN

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ADMIN DEPARTMENT TOTAL: $5,208

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ENGINEERING DEPARTMENT TOTAL: $21,738

AVERAGES FOR 13 EMPLOYEES

INCOME: $65,923	DAYS: 15.15	BUYOUT: $3,672

TOTALS FOR 13 EMPLOYEES

INCOME: $857,000	DAYS: 197	BUYOUT: $47,738

WIDGET CO
1 Widget Lane
City, State, 12345

Tel: (800) 123-4567
Fax: (800) 123-4568

Other offices
Sacramento, CA
Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI

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1. Change the font of our **EMPLOYEE VACATION REPORT** label and moved it from outside the table into the **department header**.
2. Add **highvalue** Dynamic Property. It needs to be a DataSet. Populate the data within the Ignition designer, under the **highvalue** dynamic property of the *Report Viewer* component just like we did in Tutorial #1. Our new SQL query:

```
SELECT *, CAST(income/360 * 1.5 * vacationdays AS SIGNED) buyout
```

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```
FROM employees WHERE (income/360 * 1.5 * vacationdays) > 5000;
```

We are creating a second DataSet that contains the subset of employees whose buyout value exceeds $5000. This will simplify our conditional average and total calculations.

3. Add yellow header rectangle and move page numbers up.
4. Resize table downward to the bottom of the page for more room.
5. Add yellow labels for summary aggregates. We will be using: **count**, **total**, and **average** and placing them under **department summary**.

Index Previous (Getting Started) Next (More Changes)

5.8.2.2.5 More changes

We now add a reprint row version to only display **EMPLOYEE VACATION REPORT** on the first page. We will also add summaries for our buyout > $5000 employees.

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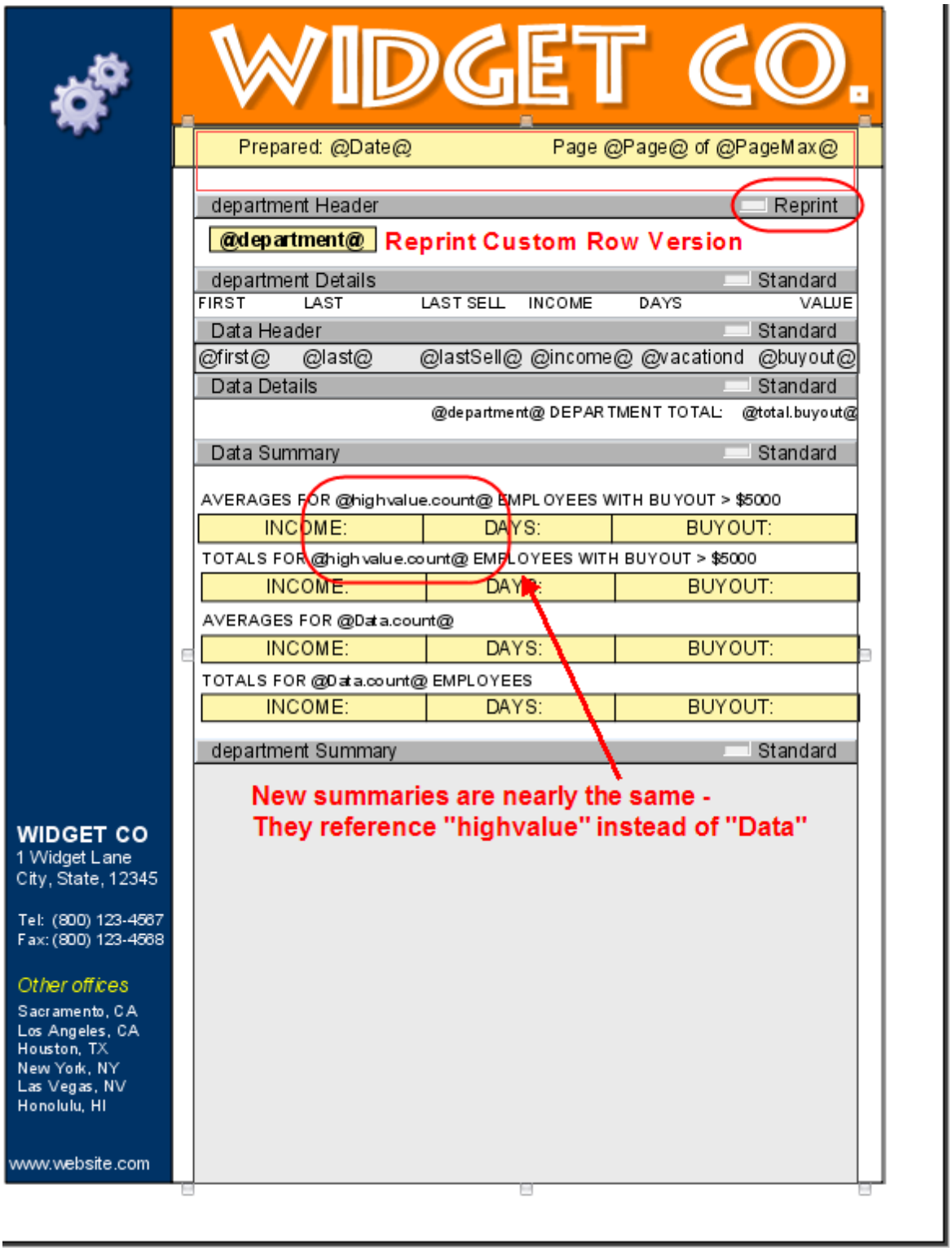

1. Add reprint row version for every other header besides the first page. Customize as necessary.
2. Add **highvalue** summaries. The process is identical to our existing summaries.

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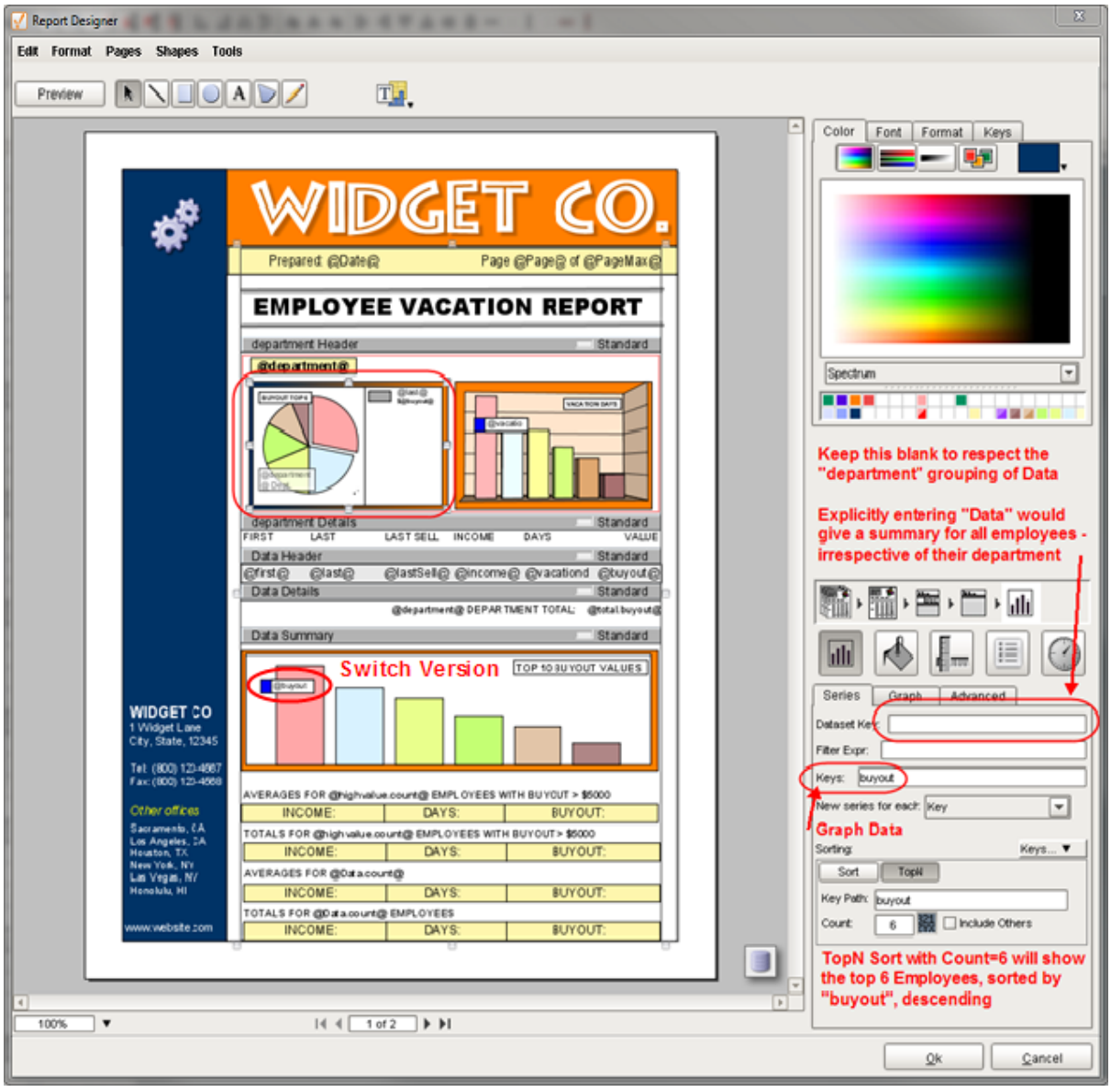
Replace **Data** with **highvalue**.

Index Previous Next (Graphs)

TIP	In this table, **Data** is implied and can be omitted since it is the table's primary DataSet. **highvalue** must be explicitly entered. For example, **@Data.count@** could have been entered **@count@**, while **@highvalue.count** could not have been simplified.

5.8.2.2.6 Graphs

Next, add Graphs to the report!



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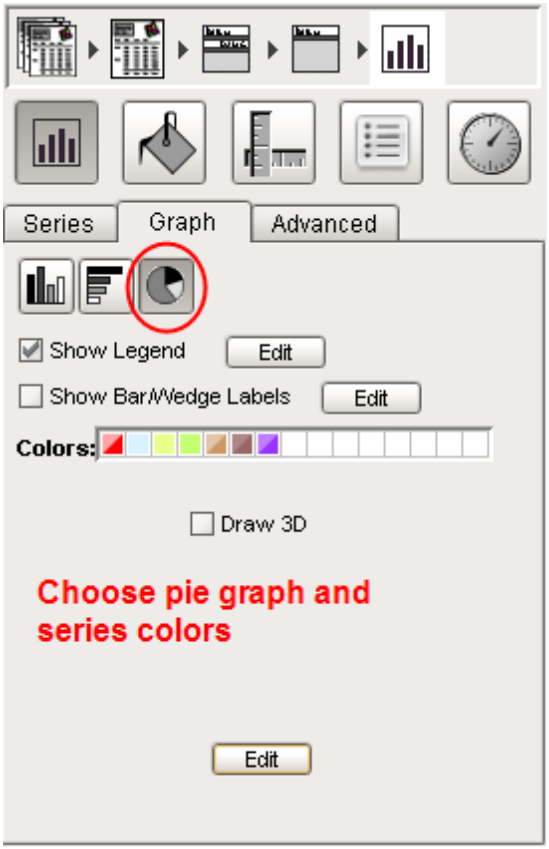
1. Drag 2 graphs down to the **department Header**. The left one will be a buyout pie graph, while the right will be a vacation days bar graph.
2. For both graphs, ensure the **Dataset Key** is blank. Found under *graph->shapespecific inspector->Series* tab. Set **Keys:** to **buyout** and **vacationdays**, respectively.
3. Make one graph a pie graph and the other a bar graph. Look for icons under *graph->shapespecific inspector->Graph* tab Notice that you can set series colors here under **Colors**.



4. Enable switch versions by checking *Show Bar/Wedge Labels*. We will add one on the top and one in the middle. Look at bar chart labels on the final screenshot for an example.

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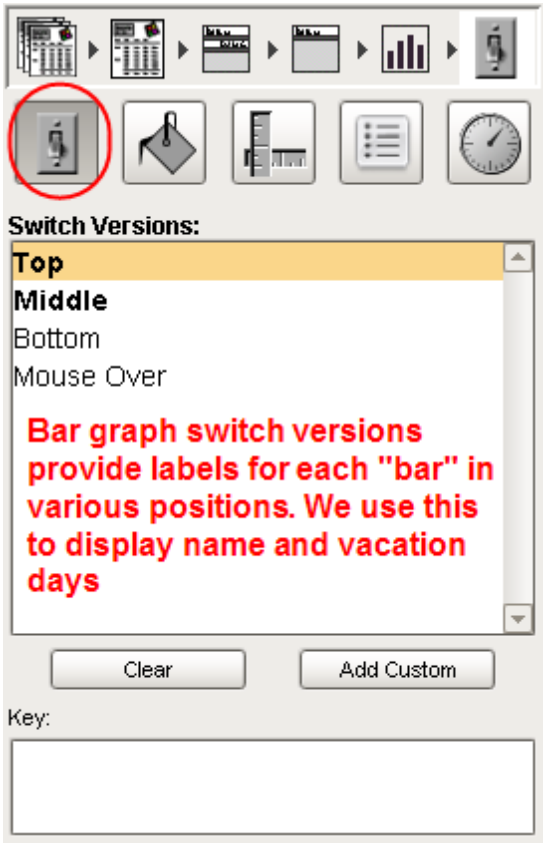

5. Use lots of double clicking to drilling down to select basic shapes and text. Change colors and fonts as desired.
6. Added semi transparent label with department subtotal (**@total.buyout@**) to the pie graph.
7. Added department label for summary bar graph using bottom switch version. **@substring(department,0,3)@** used string functions to display a 3 letter abbreviation.

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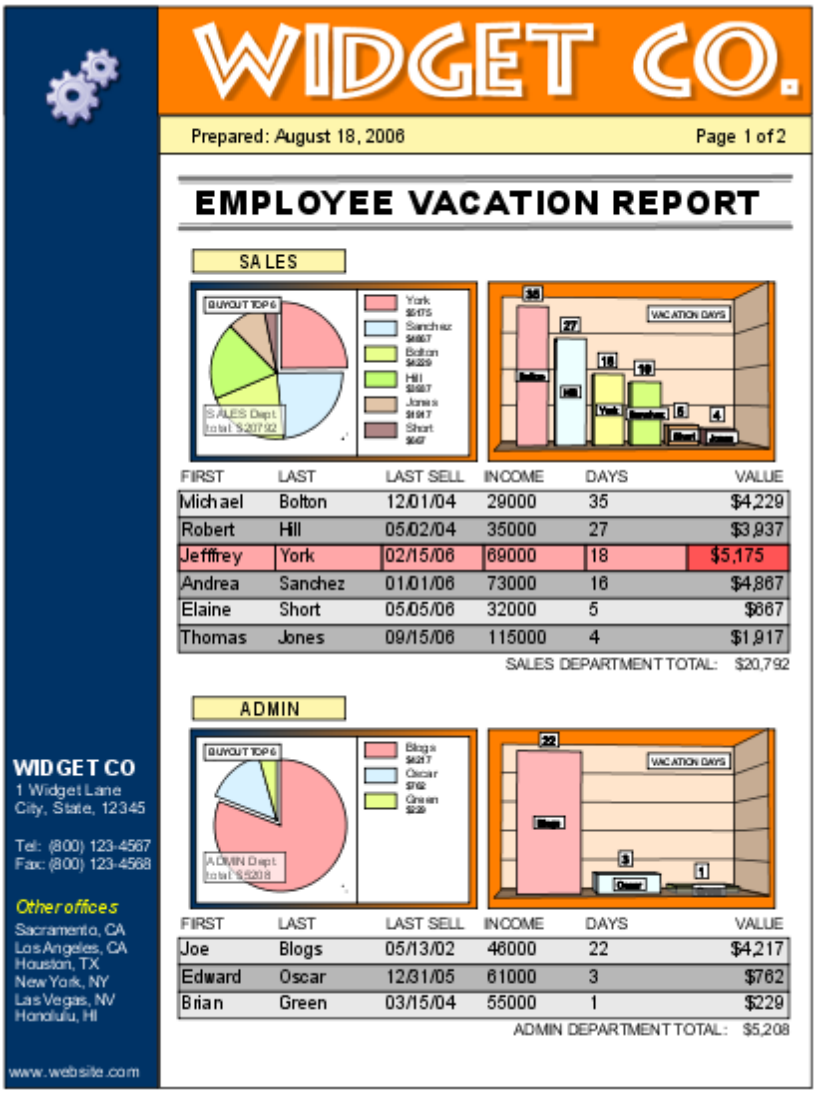

WIDGET CO.

Prepared: August 18, 2006 Page 1 of 2

EMPLOYEE VACATION REPORT

SALES

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Michael	Bolton	12/01/04	29000	35	$4,229
Robert	Hill	05/02/04	35000	27	$3,937
Jeffrey	York	02/15/06	69000	18	$5,175
Andrea	Sanchez	01/01/06	73000	16	$4,867
Elaine	Short	05/05/06	32000	5	$667
Thomas	Jones	09/15/06	115000	4	$1,917

SALES DEPARTMENT TOTAL: $20,792

ADMIN

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Joe	Blogs	05/13/02	46000	22	$4,217
Edward	Oscar	12/31/05	61000	3	$762
Brian	Green	03/15/04	55000	1	$229

ADMIN DEPARTMENT TOTAL: $5,208

WIDGET CO
1 Widget Lane
City, State, 12345

Tel: (800) 123-4567
Fax: (800) 123-4568

Other offices
Sacramento, CA
Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI

www.website.com

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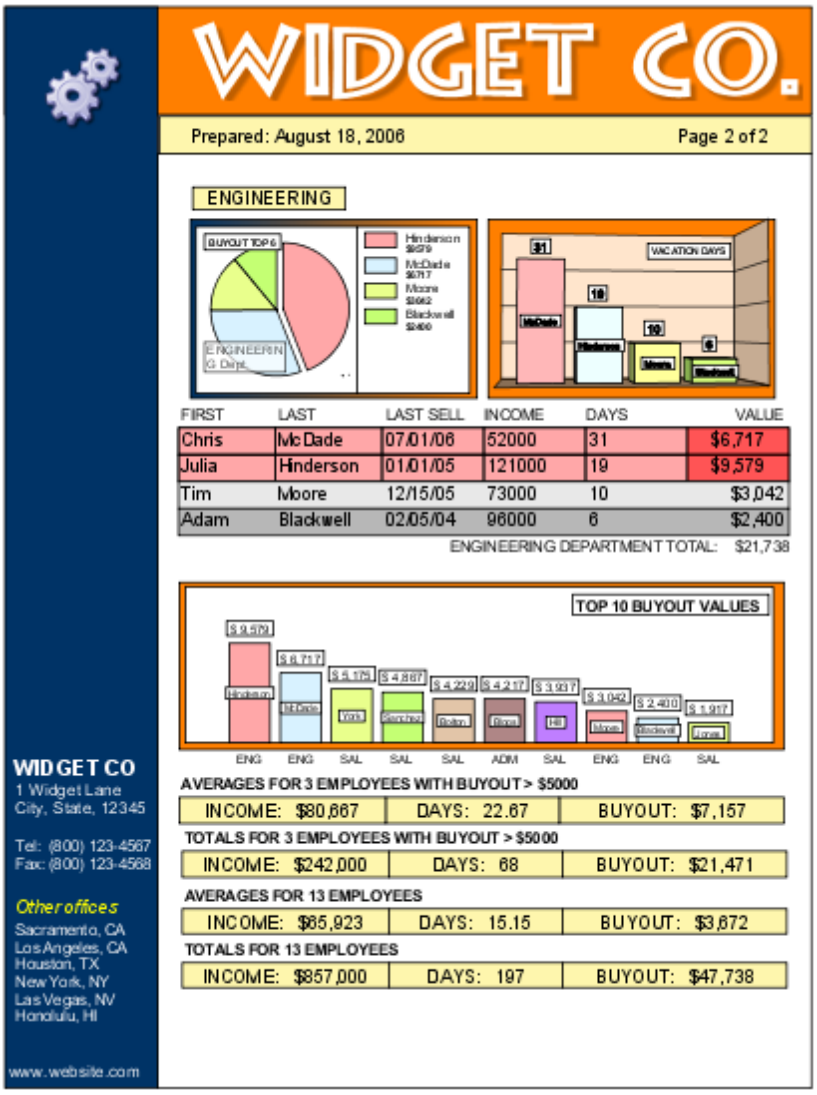
WIDGET CO.
Prepared: August 18, 2006
Page 2 of 2
ENGINEERING
BUYOUT TOP 6
VACATION DAYS
FIRST LAST LAST SELL INCOME DAYS VALUE
Chris McDade 07/01/06 52000 31 $6,717
Julia Hinderson 01/01/05 121000 19 $9,579
Tim Moore 12/15/05 73000 10 $3,042
Adam Blackwell 02/05/04 96000 6 $2,400
ENGINEERING DEPARTMENT TOTAL: $21,738
TOP 10 BUYOUT VALUES
AVERAGES FOR 3 EMPLOYEES WITH BUYOUT > $5000
INCOME: $80,667 DAYS: 22.67 BUYOUT: $7,157
TOTALS FOR 3 EMPLOYEES WITH BUYOUT > $5000
INCOME: $242,000 DAYS: 68 BUYOUT: $21,471
AVERAGES FOR 13 EMPLOYEES
INCOME: $85,923 DAYS: 15.15 BUYOUT: $3,672
TOTALS FOR 13 EMPLOYEES
INCOME: $857,000 DAYS: 197 BUYOUT: $47,738
WIDGET CO
1 Widget Lane
City, State, 12345
Tel: (800) 123-4567
Fax: (800) 123-4568
Other offices
Sacramento, CA
Los Angeles, CA
Houston, TX
New York, NY
Las Vegas, NV
Honolulu, HI
www.website.com

Index Previous (More Changes) On to Tutorial 3

TIP

The toughest part of creating small graphs is labeling the data legibly. This takes a little practice. Don't hesitate to mess up your report playing with options, then click cancel in the customizer window and start over again. You'll get the hang of it in no time!

5.8.2.3 Tutorial #3 - PDF Example

Tutorial #3 turns an existing PDF file into a dynamic report

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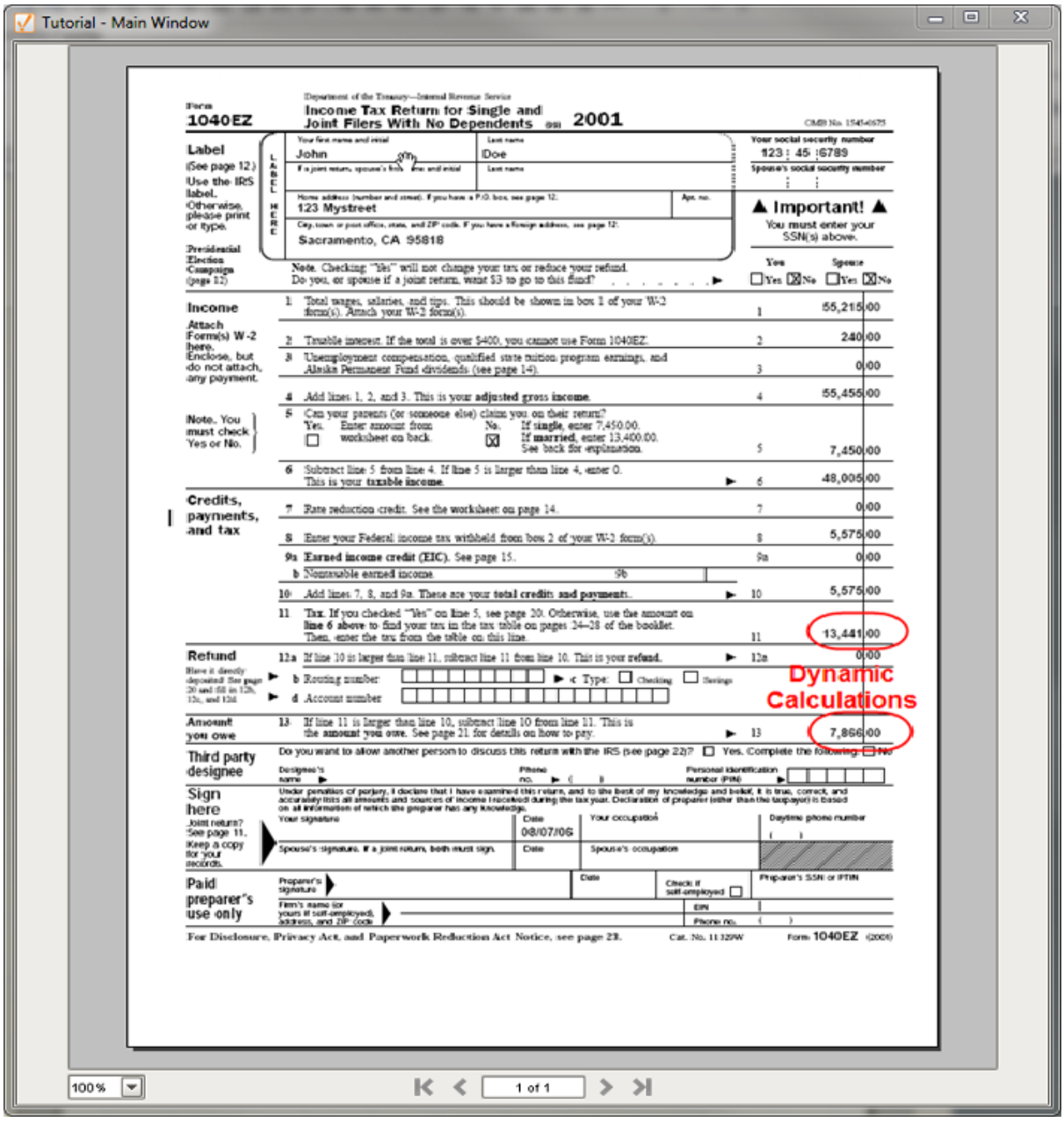
Tutorial - Main Window
Form 1040EZ
Income Tax Return for Single and Joint Filers With No Dependents
2001
Label
(See page 12.)
Use the IRS label. Otherwise, please print or type.
Presidential Election Campaign (page 12)
Your first name and initial
John
Last name
Doe
Your social security number
123 45 6789
Spouse's social security number
Home address (number and street). If you have a P.O. box, see page 12.
123 Mystreet
Apt. no.
City, town or post office, state, and ZIP code. If you have a foreign address, see page 12.
Sacramento, CA 95818
Important!
You must enter your SSN(s) above.
Note. Checking "Yes" will not change your tax or reduce your refund.
Do you, or spouse if a joint return, want $3 to go to this fund?
Yes
No
Income
Attach Form(s) W-2 here. Enclose, but do not attach, any payment.
1 Total wages, salaries, and tips. This should be shown in box 1 of your W-2 form(s). Attach your W-2 form(s). 1 55,215 00
2 Taxable interest. If the total is over $400, you cannot use Form 1040EZ. 2 240 00
3 Unemployment compensation, qualified state tuition program earnings, and Alaska Permanent Fund dividends (see page 14). 3 0 00
4 Add lines 1, 2, and 3. This is your adjusted gross income. 4 55,455 00
Note. You must check Yes or No.
5 Can your parents (or someone else) claim you on their return?
Yes. Enter amount from worksheet on back.
No. If single, enter 7,450.00. If married, enter 13,400.00. See back for explanation.
5 7,450 00
6 Subtract line 5 from line 4. If line 5 is larger than line 4, enter 0. This is your taxable income. 6 48,005 00
Credits, payments, and tax
7 Rate reduction credit. See the worksheet on page 14. 7 0 00
8 Enter your Federal income tax withheld from box 2 of your W-2 form(s). 8 5,575 00
9a Earned income credit (EIC). See page 15. 9a 0 00
b Nontaxable earned income 9b
10 Add lines 7, 8, and 9a. These are your total credits and payments. 10 5,575 00
11 Tax. If you checked "Yes" on line 5, see page 20. Otherwise, use the amount on line 6 above to find your tax in the tax table on pages 24–28 of the booklet. Then, enter the tax from the table on this line. 11 13,441 00
Refund
12a If line 10 is larger than line 11, subtract line 11 from line 10. This is your refund. 12a 0 00
b Routing number
c Type: Checking Savings
d Account number
Dynamic Calculations
Amount you owe
13 If line 11 is larger than line 10, subtract line 10 from line 11. This is the amount you owe. See page 21 for details on how to pay. 13 7,866 00
Third party designee
Do you want to allow another person to discuss this return with the IRS (see page 22)? Yes. Complete the following. No
Designee's name
Phone no.
Personal identification number (PIN)
Sign here
Joint return? See page 11. Keep a copy for your records.
Under penalties of perjury, I declare that I have examined this return, and to the best of my knowledge and belief, it is true, correct, and accurately lists all amounts and sources of income I received during the tax year. Declaration of preparer (other than the taxpayer) is based on all information of which the preparer has any knowledge.
Your signature
Date
08/07/06
Your occupation
Daytime phone number
Spouse's signature. If a joint return, both must sign.
Date
Spouse's occupation
Paid preparer's use only
Preparer's signature
Date
Check if self-employed
Preparer's SSN or PTIN
Firm's name (or yours if self-employed), address, and ZIP code
EIN
Phone no.
For Disclosure, Privacy Act, and Paperwork Reduction Act Notice, see page 28.
Cat. No. 11329W
Form 1040EZ (2006)
100%
1 of 1

[Background]

[Creating our report]

[Next (Background)]

5.8.2.3.2 Background

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Widget Co. wants to automatically generate 1040EZ forms for its employees taxes.

Here are the requirements:

1. Start with an existing pdf report.
2. Dynamically fill in: name, income, withholdings, dependents, and other details.
3. Dynamically calculate taxes based on an expression.
4. Display a check mark (isVisible condition) based on an expression.
5. Allow users to print report or save as a pdf.

Previous (Index) Next (Creating Our Report)

5.8.2.3.3 Creating the report

Widget Co. wants to automatically generate 1040EZ forms for its employees taxes.

Here are the requirements:

1. Start with an existing pdf report.
2. Drag in keys
3. Users can print report or save as a pdf by right clicking the report.

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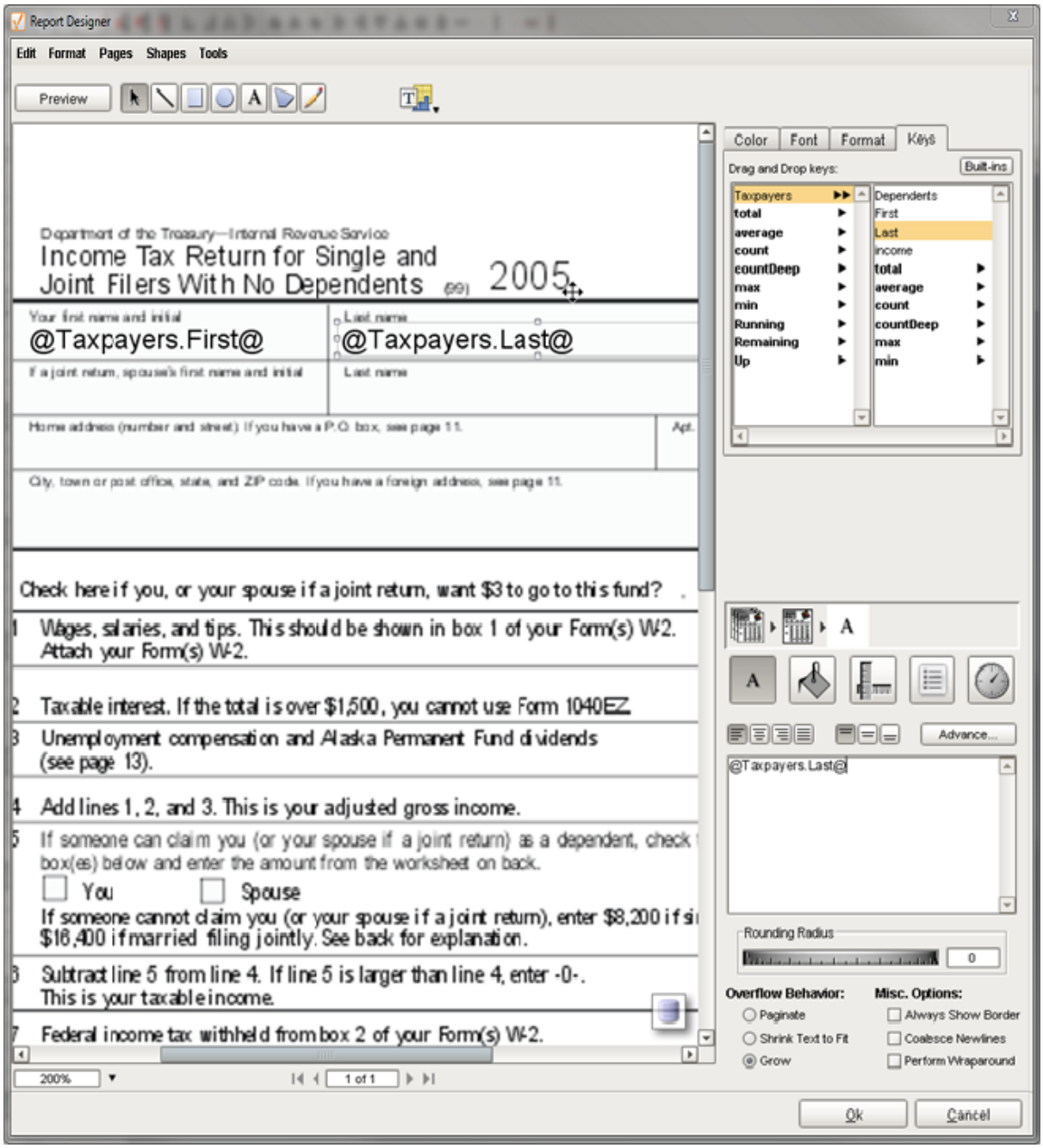
Report Designer
Edit Format Pages Shapes Tools
Preview
Department of the Treasury—Internal Revenue Service
Income Tax Return for Single and
Joint Filers With No Dependents (99) 2005
Your first name and initial
@Taxpayers.First@
Last name
@Taxpayers.Last@
If a joint return, spouse's first name and initial
Last name
Home address (number and street). If you have a P.O. box, see page 11.
Apt.
City, town or post office, state, and ZIP code. If you have a foreign address, see page 11.
Check here if you, or your spouse if a joint return, want $3 to go to this fund?
1 Wages, salaries, and tips. This should be shown in box 1 of your Form(s) W-2. Attach your Form(s) W-2.
2 Taxable interest. If the total is over $1,500, you cannot use Form 1040EZ.
3 Unemployment compensation and Alaska Permanent Fund dividends (see page 13).
4 Add lines 1, 2, and 3. This is your adjusted gross income.
5 If someone can claim you (or your spouse if a joint return) as a dependent, check box(es) below and enter the amount from the worksheet on back.
You
Spouse
If someone cannot claim you (or your spouse if a joint return), enter $8,200 if si $16,400 if married filing jointly. See back for explanation.
6 Subtract line 5 from line 4. If line 5 is larger than line 4, enter -0-. This is your taxable income.
7 Federal income tax withheld from box 2 of your Form(s) W-2.
200%
1 of 1
Color Font Format Keys
Drag and Drop keys:
Built-ins
Taxpayers
total
average
count
countDeep
max
min
Running
Remaining
Up
Dependents
First
Last
income
total
average
count
countDeep
max
min
Advance...
@Taxpayers.Last@
Rounding Radius
0
Overflow Behavior:
Paginate
Shrink Text to Fit
Grow
Misc. Options:
Always Show Border
Coalesce Newlines
Perform Wraparound
Ok
Cancel

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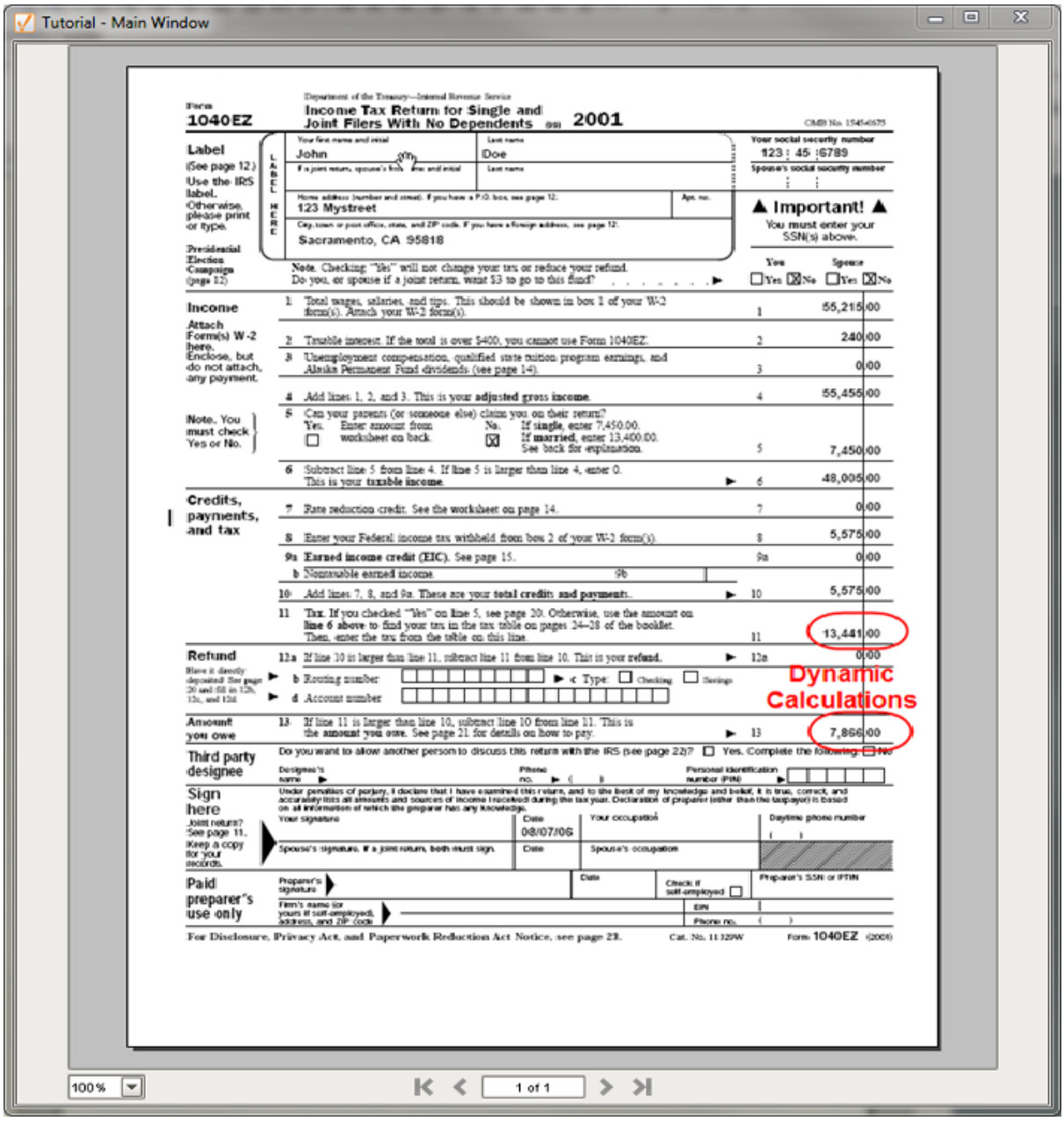
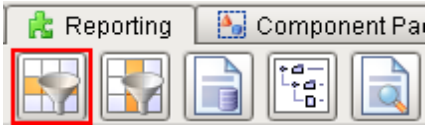


Previous (Index)

5.8.3 Components

5.8.3.1 Ignition Components

5.8.3.1.1 Row Selector

Icon in toolbar: 

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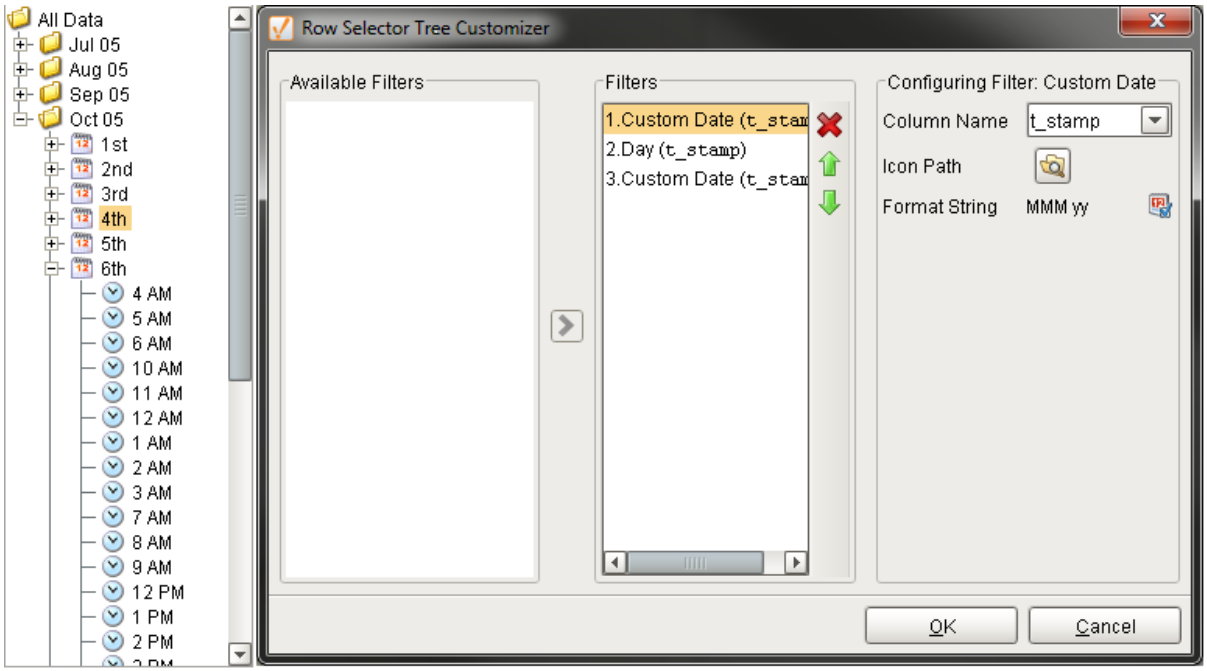
Description



The selected data will output all data from Oct 4, 2005

The *Row Selector* is a component that allows users to filter a DataSet based on unique values of one or more columns. Each level in the sorting tree is based on these properties.

The user will see a dynamically generated expandable tree that groups their data by any number of choices. As they click down the tree, objects bound to the DataSet will indicate the filtered data. Here are a few examples.

A line graph bound to a *Row Selector*. Set up grouping to be first by month and year, then day, then hour, like the top left illustration. Clicking on a month and year will dynamically update the graph for that time period. Further clicking to a specific day or hour will re-filter the graph for that period.

A Report Viewer bound to a *Row Selector*. Grouping by department (String) would allow selection by department, automatically regenerating the Report on selection.

An "alarm history" table bound to a *Row Selector*. This could first be broken down severity level (Integer), then broken into "Alarm Acknowledged" / "Not Acknowledged" (Boolean based). Clicking "Severity 3" would filter the table to all Severity 3 alarms. Selecting "Unacknowledged" would then filter the table to unacknowledged alarms of severity 3.

Properties

Show All Data Node	`showAllDataNode`	BOOLEAN
Displays or hides the 'All Data' (root) node.		
Show Root	`showRootHandles`	BOOLEAN

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Handles		

If true, root node(s) will have collapsible handles like child nodes.

Show Node Size	`showNodeSize`	BOOLEAN

If true, the number of nodes in each row will be shown.

Properties Loading	`propertiesLoading`	INTEGER

Indicates number of dataSets loading. This is strictly a bindable property. It can be used as status indication to the user that data is loading.

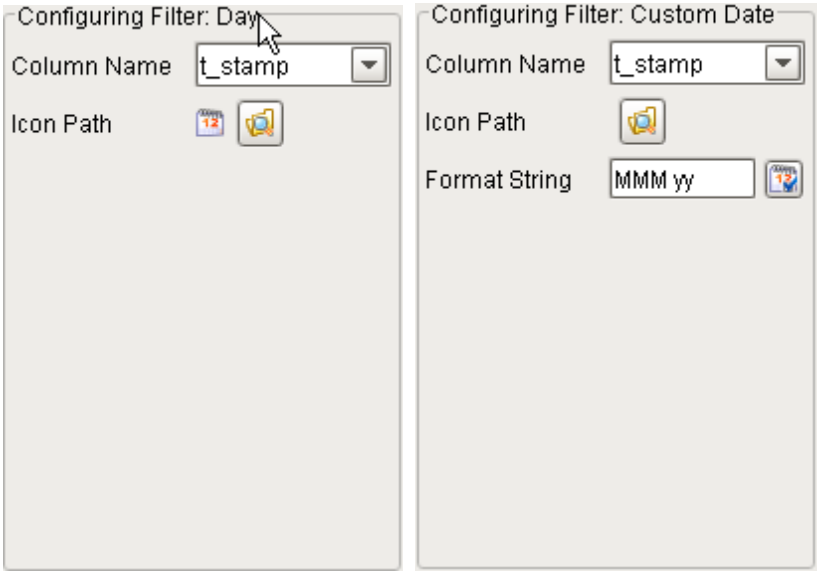
Customizer

The *Row Selector* customizer defines *Filters* that allow each level of user data filtering. Browse through the tree of **Available Filters**, then drag the desired filter to the *filter* pane. Different options will be available under **Configure Filter**: *FilterType* based on the filter type.

Common Filter Properties

Property	Function
Column Name	Allows selection of date column
Icon Path	Click to choose a graphic for each node.

Date Filters



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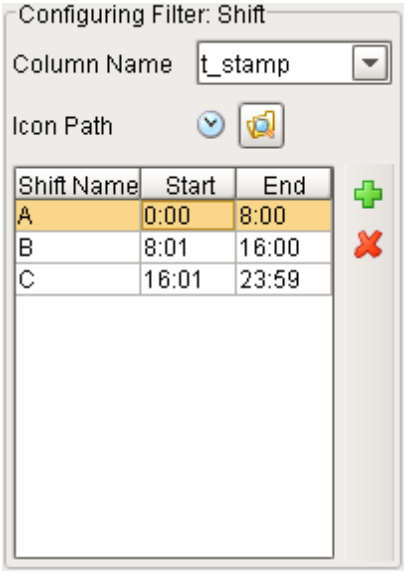
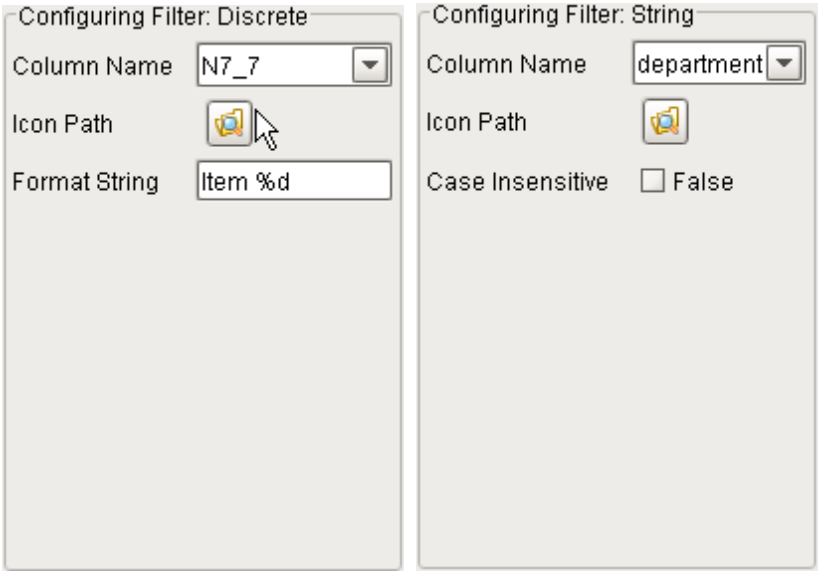


Different options for time columns

The **Day** (*Date*) filter separates rows by day.
The **Custom Date** (*Date*) filter uses pattern masks in the **Format String** for a flexible date criteria definition.
The **Shift** (*Date*) filter breaks up data into shifts, which are named defined time ranges.

Other Filters



The **Discreet** (*Integer*) filter breaks rows down by unique integer. **Format String** allows you to define the text string that the user sees.
The **String** (*String*) filter breaks rows down by unique string. **Case Insensitive** defines case sensitivity.

Events

mouse

```
mouseClicked
```

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mouseEntered

mouseExited

mousePressed

mouseReleased

mouseMotion

mouseDragged

mouseMoved

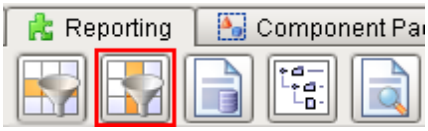
propertyChange

propertyChange

Scripting Functions

TIP The *Row Selector* works well with the: Report Viewer, Graph, and Table components!

5.8.3.1.2 Column Selector

Icon in toolbar: 

Description

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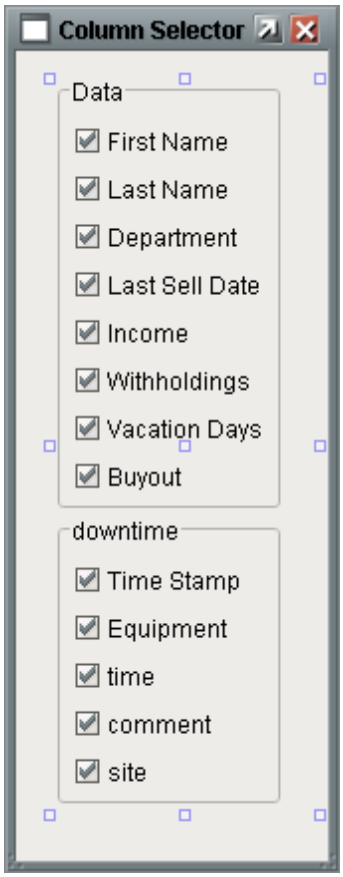

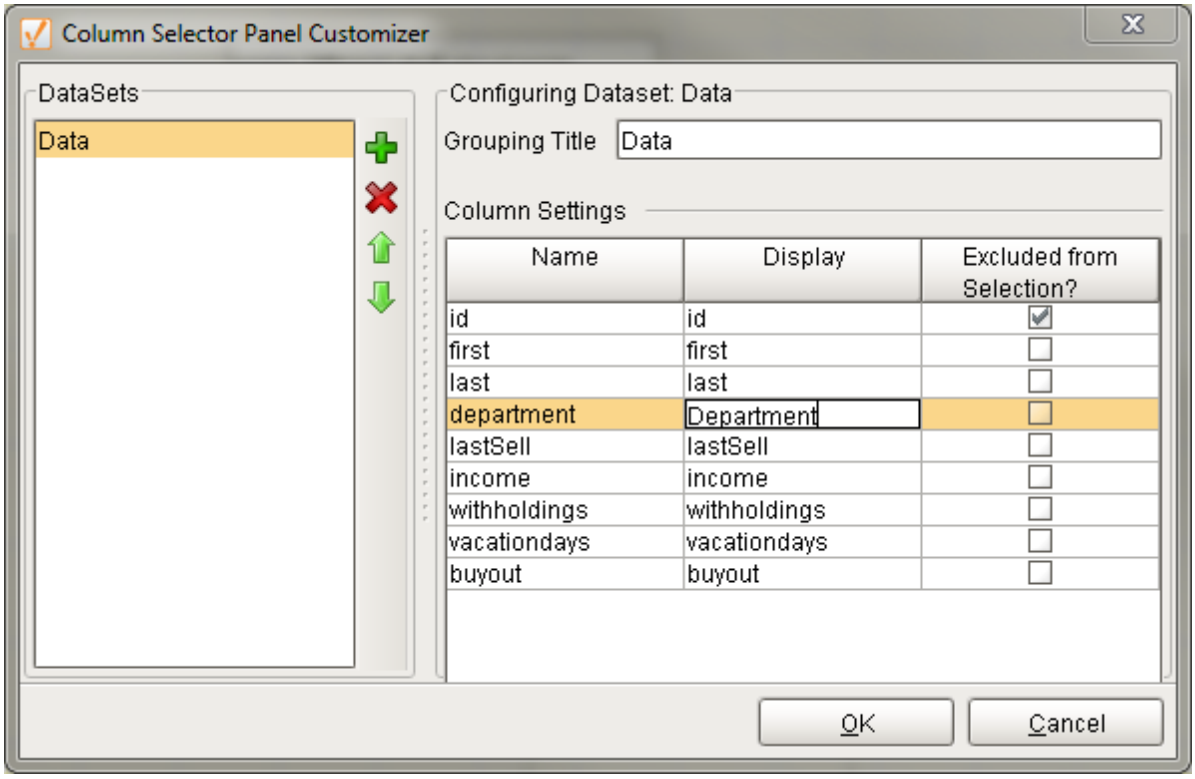

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The *Column Selector* is a component that takes DataSets in, allows users to show or hide variables in the DataSets (Columns) via checkboxes, then outputs the resulting DataSet.

The *Column Selector* allows users to choose which columns in a DataSet that they wish to use. If an object is bound to the *Column Selector* it will update itself whenever a user checks or unchecks a column. This allows users to dynamically show/hide: Table columns, "pens" on a graph, data in a Report Viewer, or any other component set up to use a DataSet.

Properties

Group by DataSet	`grouping`	BOOLEAN

Displays each DataSet's columns in a separate bordered container. Applicable to multiple DataSets only.

Alphabetize	`alphabetize`	BOOLEAN

Orders columns alphabetically as opposed to their native order in the DataSet .

Normalize Widths	`normalizeWidths`	BOOLEAN

If true, all checkboxes will be assigned the same width, which causes them to line up in columns

Horizontal Gap	`hGap`	INTEGER

The horizontal gap, in pixels, between checkboxes and grouping panels.

Vertical Gap	`vGap`	INTEGER

The vertical gap, in pixels, between checkboxes and grouping panels.

Customizer

The *Column Selector* customizer is very straightforward. The left pane allows you to add and remove DataSets. Selecting a DataSet will display a list of columns in the table in the right pane. Under *Display* you may modify the name that users see. *Excluded from Selection* will remove the given column from the users list of choices.

Events

mouse

- `mouseClicked`
- `mouseEntered`
- `mouseExited`
- `mousePressed`
- `mouseReleased`

mouseMotion

- `mouseDragged`
- `mouseMoved`

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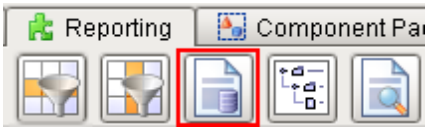
propertyChange

propertyChange

Scripting Functions

TIP	The *Column Selector* works well with the Ignition Graph and Table components!

5.8.3.1.3 Report Viewer

Icon in toolbar: 

Description

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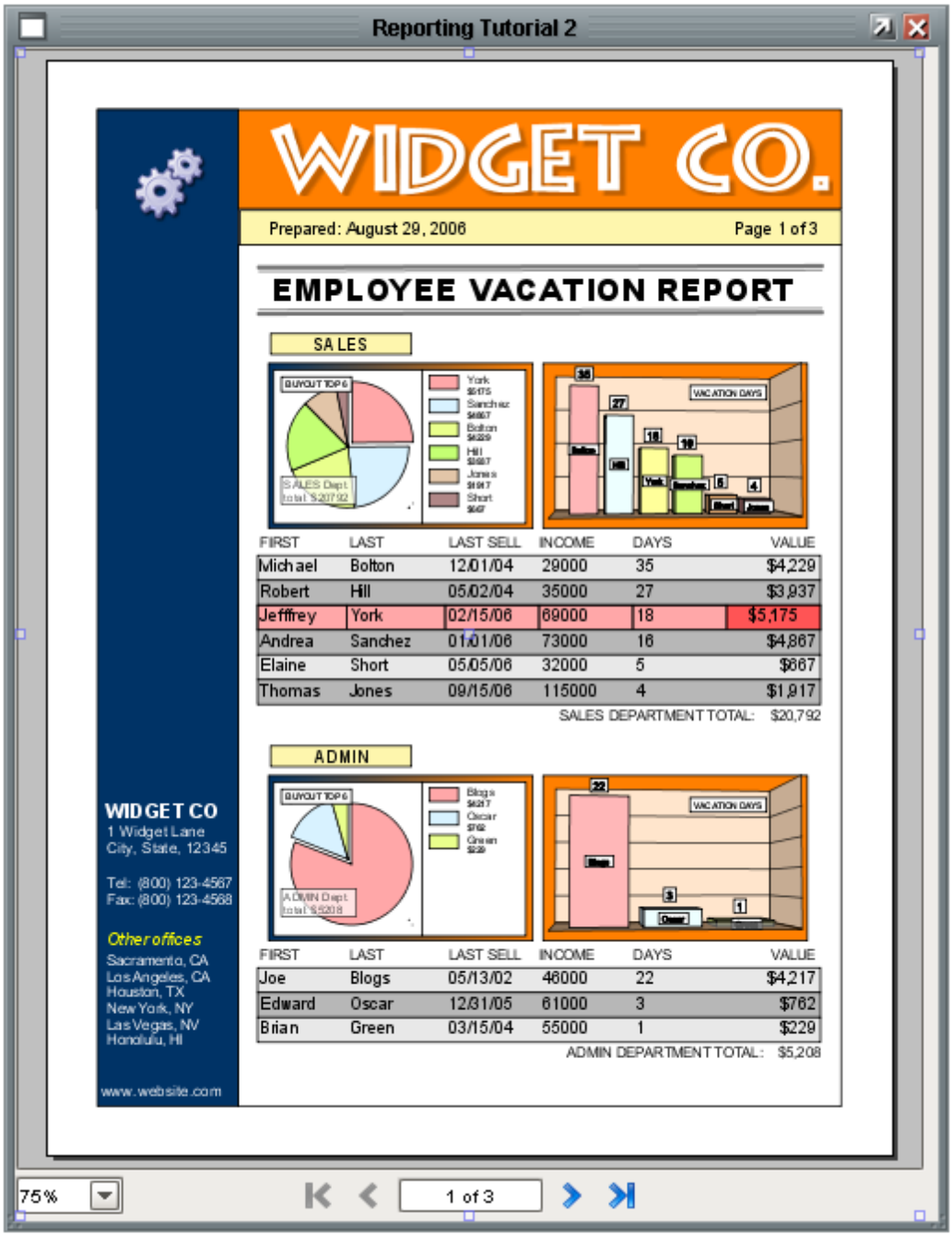

The *Report Viewer* is the component that displays reports within Ignition. Dynamic Properties bring data from Ignition into the report. Any changes to the dynamic data automatically regenerates the report. Customization is done in the Report Designer via the customizer (Cntl+U)

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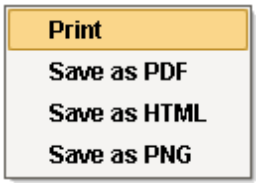

Users can zoom in to the report and scroll between pages with the builtin controls located at the bottom. Right clicking anywhere on a report in the *Report Viewer* in the Runtime will allow you to print or save the report in several formats.

Properties

Zoom Factor	`zoomFactor`	INT

This variable sets and displays the current zoom level of the report.

Customizer

The customizer for this class is the Report Designer. It lets you add, remove, and edit properties for the Report's datasets as well as create entire reports.

Events

mouse
- `mouseClicked`
- `mouseEntered`
- `mouseExited`
- `mousePressed`
- `mouseReleased`

mouseMotion
- `mouseDragged`
- `mouseMoved`

propertyChange
- `propertyChange`

Scripting Functions

print ([`printerName`] , [`showDialog`])

Prompts the report to print. The optional arguments can be used to specify the name of the printer to use, and whether or not to show the user the print options dialog box.

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Parameters

[printerName]

The name of the printer to print to. Omit or use `None` to use the default printer.

[showDialog]

A boolean (0 or 1) indicating whether or not to show the user the print dialog options box.

Example:

```
# This would prompt the user to print, showing them the print dialog box and starting with the
report = event.source.parent.getComponent("Report Viewer")
report.print()
```

Example:

```
# This would print to the "HP Laserjet" printer with no user interaction
report = event.source.parent.getComponent("Report Viewer")
report.print("HP Laserjet", 0)
```

Example:

```
# This would print to the default printer with no user interaction
report = event.source.parent.getComponent("Report Viewer")
report.print(None, 0)
```

getBytesHTML(continuous)

Creates an HTML byte array of the report generated.

Parameters

continuous

Create a paged HTML document or a continuous HTML document

Example:

```
# This code would prompt the user to save the HTML bytes to a file
path = fpmi.file.saveFile("myfile.html")
if path != None:
 fpmi.file.writeFile(path, report.getBytesHTML(1))
```

getBytesPDF( )

Creates an HTML byte array of the report generated.

Example:

```
# This code would prompt the user to save the PDF bytes to a file
path = fpmi.file.saveFile("myfile.pdf")
if path != None:
 fpmi.file.writeFile(path, report.getBytesPDF())
```

saveAsHTML(filename, continuous)

Saves the generated report as HTML to the specified filename.

Parameters

filename

The filename, such as myfile.html

continuous

Create a paged HTML document or a continuous HTML document

saveAsPDF(filename)

Saves the generated report as a PDF to the specified filename.

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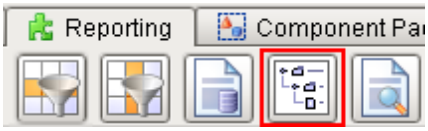
Parameters	
	filename
	The filename, such as myfile.pdf

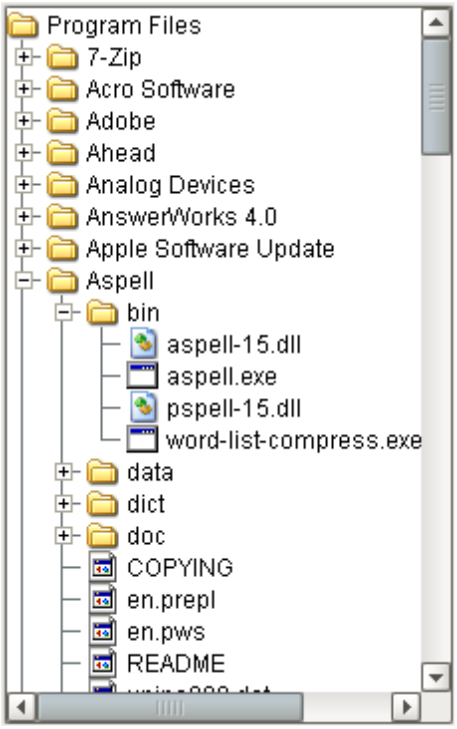
saveAsPNG(`filename`)

Saves the generated report as a PNG to the specified filename.

Parameters	
	filename
	The filename, such as myfile.png

5.8.3.1.4 File Explorer

Icon in toolbar: 



The File Explorer rooted at "C:\Program Files"

Description

The File Explorer component displays a filesystem tree to the user. It can be rooted at any folder, even network folders. It can also filter the types of files that are displayed by their file extension (For example, "**pdf**"). The path to the file that the user selects in the tree is exposed in the bindable property **Selected Path**.

This component is typically used in conjuction with the PDF Viewer component, in order to

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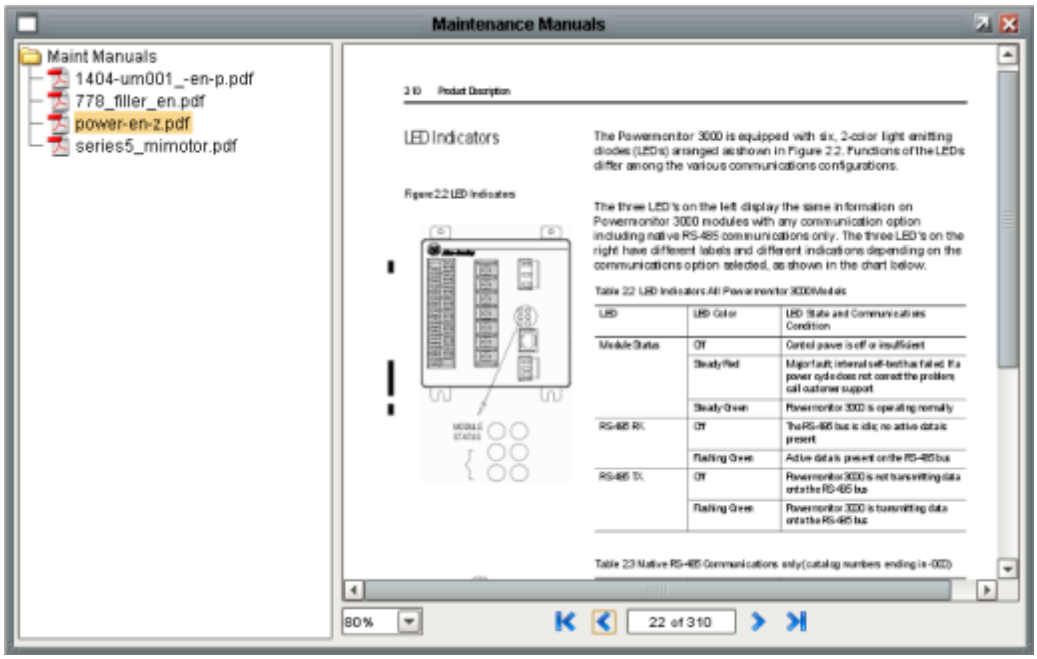
create a PDF viewing window. This is very useful for viewing things like maintenance manuals from within your project. To create a window like the one shown below follow these steps:

1. Bind the PDF Viewer's **Filename** property to the File Explorer's **Selected Path** property
2. Set the File Explorer's **File extension filter** to "pdf"
3. Set the File Explorer's **Root Directory** to a network folder that has your maintenance manuals in it. (Use a network folder so that all clients will be able to access the manuals).



The File Explorer used with the PDF Viewer for manual viewing.

Properties

Selected Path	`selectedPath`	STRING

This Read-Only property provides the path to the selected file or folder.

Selected Path Is File	`selectedPathIsFile`	BOOLEAN

This Read-Only property is true when the selected path is a file, and false otherwise (i.e., the selected path is a folder).

File extension filter	`fileFilter`	STRING

A semicolon separated list of file extensions to display, such as "**pdf**" or "**html;htm;txt;rtf**". Leave blank to show all file types.

Root Directory	`rootDir`	STRING

The path to the root folder to display. Examples: "**C:\Program Files**" or "**\\fileserver\manuals\Maint Manuals**". If blank, the local system's filesystem

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root is used.

Customizer

None.

Events

mouse

mouseClicked

mouseEntered

mouseExited

mousePressed

mouseReleased

mouseMotion

mouseDragged

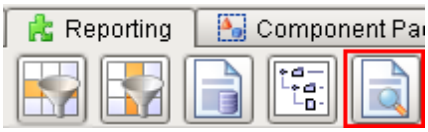
mouseMoved

propertyChange

propertyChange

Scripting Functions

5.8.3.1.5 PDF Viewer

Icon in toolbar: 

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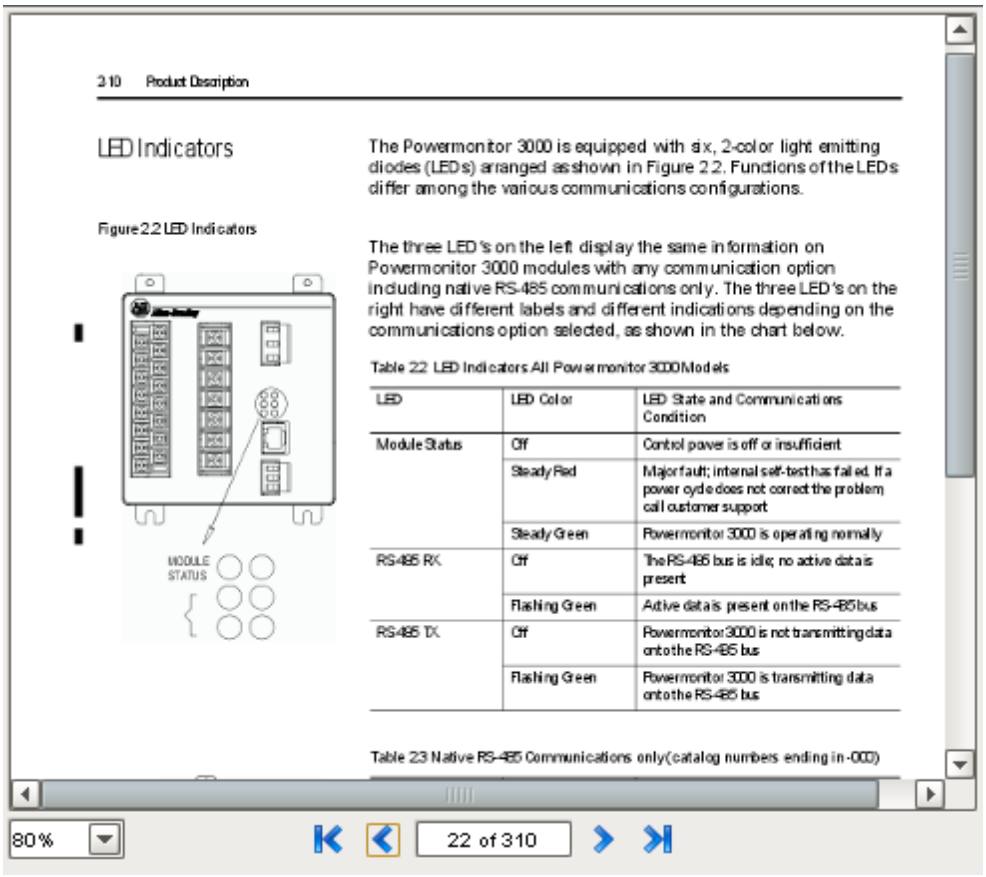
2-10 Product Description
LED Indicators
The Powermonitor 3000 is equipped with six, 2-color light emitting diodes (LEDs) arranged as shown in Figure 2.2. Functions of the LEDs differ among the various communications configurations.
Figure 2.2 LED Indicators
The three LED's on the left display the same information on Powermonitor 3000 modules with any communication option including native RS-485 communications only. The three LED's on the right have different labels and different indications depending on the communications option selected, as shown in the chart below.
Table 2.2 LED Indicators All Powermonitor 3000 Models
LED
LED Color
LED State and Communications Condition
Module Status
Off
Control power is off or insufficient
Steady Red
Major fault; internal self-test has failed. If a power cycle does not correct the problem call customer support
Steady Green
Powermonitor 3000 is operating normally
RS-485 RX
Off
The RS-485 bus is idle; no active data is present
Flashing Green
Active data is present on the RS-485 bus
RS-485 TX
Off
Powermonitor 3000 is not transmitting data onto the RS-485 bus
Flashing Green
Powermonitor 3000 is transmitting data onto the RS-485 bus
Table 2.3 Native RS-485 Communications only (catalog numbers ending in -000)
MODULE STATUS
80%
22 of 310

The PDF Viewer viewing a maintenance manual.

Description

The PDF Viewer component displays a PDF that exists as a file in some accessable filesystem, or as a URL. Note that this component is simply for viewing existing PDFs - for creating dynamic reports, use the Report Viewer component.

This component is typically used in conjuction with the File Explorer component, in order to create a PDF viewing window. See the File Explorer's documentation for instructions on how to put these two components together.

Properties

Filename	`filename`	STRING

The path or URL to the PDF file to display. Examples: "**C:\PDFFiles\example.pdf**", "**\\fileserver\manuals\valve-2.pdf**", or "**http:\\www.example.com\test.pdf**".

Zoom Factor	`zoomFactor`	FLOAT

The zoom factor of the viewer. 1=100%.

Customizer

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None.

Events

mouse

mouseClicked

mouseEntered

mouseExited

mousePressed

mouseReleased

mouseMotion

mouseDragged

mouseMoved

propertyChange

propertyChange

Scripting Functions

setBytes(bytes)

Sets the PDF document to a byte array. Useful for loading a PDF document from a SQL database.

Parameters	
	bytes
	The PDF byte array to display.

Example:

```
# This code would prompt the user to choose a pdf file. If the user chooses a file,
# it would then read that file into a byte array and call setBytes.
path = fpmi.file.openFile('pdf')
if path != None:
 bytes = fpmi.file.readFileAsBytes(path)
 pdfViewer.setBytes(bytes)
```

Example 2:

```
# This would get the PDF bytes from a SQL database
bytes = fpmi.db.runScalarQuery("SELECT PDFBlob FROM PDFTable WHERE ID = 1")
pdfViewer.setBytes(bytes)
```

5.8.3.2 ReportViewer Components

5.8.3.2.1 Basic Drawing Tools

Basic drawing tools are found on the toolbar

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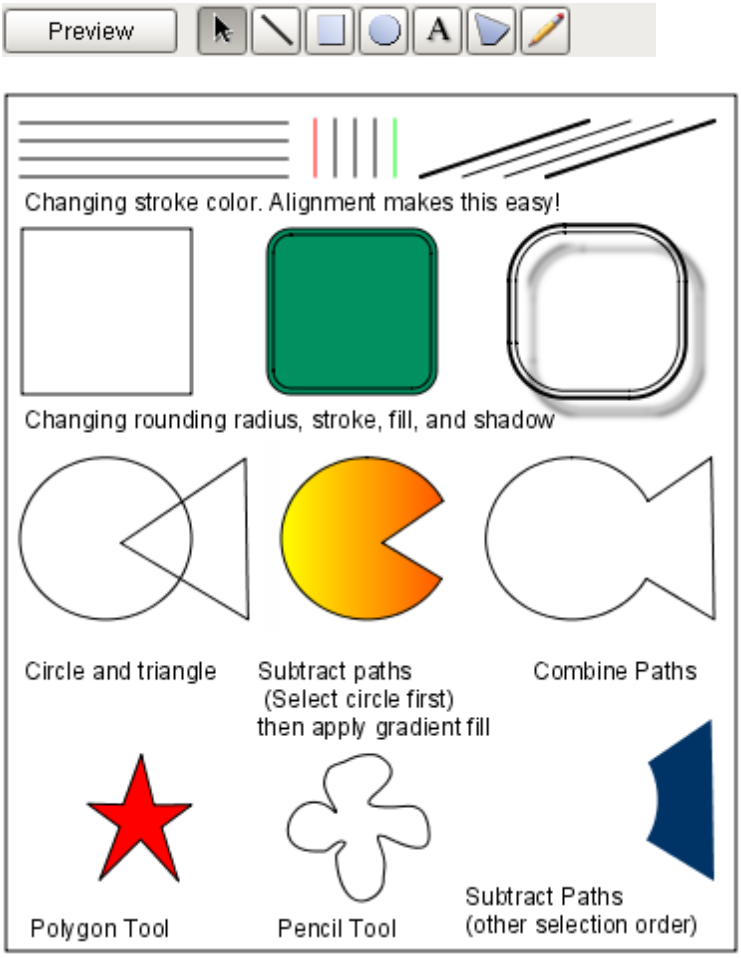

Examples using the drawing tools

Drawing tools

Icon	Name	Description
	Toggle Preview/ Edit Mode	Toggles between Preview and Edit modes. This is equivalent to going between Preview and Design mode in the Ignition designer. **Edit mode** will allow you to make changes to the layout of the report. **Preview mode** will populate the report with data and show you what it will look like in the runtime.
	Selection Tool	Default tool. Clicking on objects with the selection tool will select them for movement or modification.
	Line Tool	Click and drag to create a line.
	Rect Tool	Click and drag to create a rectangle. The Rect inspector will allow you to set rounding radius.
	Oval Tool	Click and drag to create an oval. The oval inspector will allow you to select sweep and start angle.
	Text Tool	Click and drag to create text. Click for more on text editing.

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	Polygon Tool	The polygon tool lets you click points that will be joined with straight lines. Alternatively, you can click-drag-release to position line segments interactively. If you hold down the alt key while adding points the polygon tool will behave like pencil for added segments. Editing stops under the following conditions: clicking the same point twice, clicking close to the start point or clicking a new tool in the tool bar (like the selection tool) .
	Pencil Tool	The pencil tool lets you click and draw free-hand path segments, automatically smoothing the curve on mouse up. If you hold down the alt key, it will behave like polygon for added segments. Editing stops under the same conditions as polygon.

Shapes Menu

This shapes menu allows you to modify the layout of objects in a report

Menu Item	Function
Group/ Ungroup	Allows you to merge the currently selected shapes into a single shape for convenient management. Contained shapes are still accessible, via double-click super-select. Ungroup separates grouped shapes.
Bring to Front/ Send to Back	All shapes have an order on the page that determines what is drawn on top when two shapes overlap. These options allow you to alter that order.
Make Row Top/Center/ Bottom	Quickly align several shapes in a row, either by their top, center, or bottom border. Useful when shapes are of different heights.
Make Column Left/Center/ Right	Same as above, but for columns.
Make Same Size, Width, Height	Make several shapes the same width, height or both.
Equally Space Row/Column	Equalizes the distance between shapes horizontally or vertically.
Group in Switch/3D Shape	**This feature groups selected shapes in a Switch Shape, which has the same features as Table Row Versions. It's a powerful way to conditionally provide a different look for a specific element.**
Move to new layer	Creates a new page layer with the currently selected shapes.
Combine/ Subtract Paths	Takes multiple overlapping shapes (such as a rectangle and an oval) and combines them into a single shape using the combined paths. A powerful tool to construct complex shapes.
Convert Into	Converts the selected shape into an image. Be sure to group

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Image	shapes first if you want to convert multiple shapes into a single image.

TIP	The Drawing Tools are really intuitive. Try them out. You'll be an expert in no time.

5.8.3.2.2 Crosstab

The *CrossTab* is a DataSet element like the table and graph. It shows a summaries of cross sections of data. To be useful, crosstab data should have the following:

Lots of repetitious data. You should be looking for sums, averages, or other aggregate functions

At least 2 (key) columns whose data are repetitious compared to the number of rows. Your data should look "rectangular". For example, If there is only one row for each combination of values of the 2 keys, you will get a trivial crosstab.

You will typically have a third column that is a number to perform an operation on. Examples are: summing money, displaying average response times, counting occurrences, etc.

The CrossTab template is much simpler than the table template. By default it just shows one cell of a simple table. This is usually configured with an aggregate key, like "@total.getAmount@". After that, grouping keys are dragged to the horizontal and vertical axis.

Example

We will use a crosstab to illustrate total downtime by equipment and location.

Employee data can be retrieved from the accounting database with the following SQL query:

```
SELECT * FROM downtime;
```

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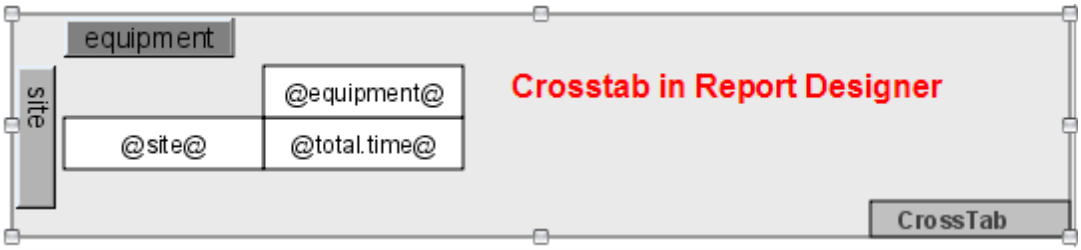
	t_stamp	equipment	time	comment	site
1	2005-12-20 17:55:00	labeler	50	Out of labels	North site
2	2005-12-22 11:55:00	filler	15	Scheduled maintenance	North site
3	2006-01-02 22:55:00	palletizer	10	Misalignment	East site
4	2006-01-03 02:55:00	conveyor line	25	backup	North site
5	2006-02-12 06:13:00	labeler	10	Scheduled maintenance	North site
6	2006-02-12 12:01:00	labeler	3	Out of labels	East site
7	2006-02-12 14:01:00	palletizer	17	Misalignment	North site
8	2006-02-12 16:23:00	conveyor line	23	Scheduled maintenance	North site
9	2006-02-12 20:04:00	filler	33	Overflow	East site
10	2006-02-12 20:13:00	labeler	21	Stuck labels	North site
11	2006-02-12 20:25:00	filler	20	Overflow	North site
12	2006-02-12 20:36:00	conveyor line	30	Scheduled maintenance	North site



Result	conveyor line	filler	labeler	palletizer
East site	<NA>	33	3	10
North site	78	35	81	17

Notice that the example only has 2 unique sites. This is because we only have 12 rows of data.

5.8.3.2.3 Graph

The *Graph* is a DataSet element like the table. It shows a 2D or 3D graphical representation of data in the form of bar graph or pie graph. Graphs are useful for illustrating relative amounts of summarized data.

Populating data including the concepts of data keys, sorting, and filtering are nearly identical to that of a table. The look of the graph has a much deeper superselection model than a table.

Example

We will explore graph options with a total downtime by equipment example. The same data is used as the table example.

A downtime summary can be retrieved with the following SQL query:

```
SELECT equipment, sum(time) AS totalDowntime FROM downtime GROUP BY
```

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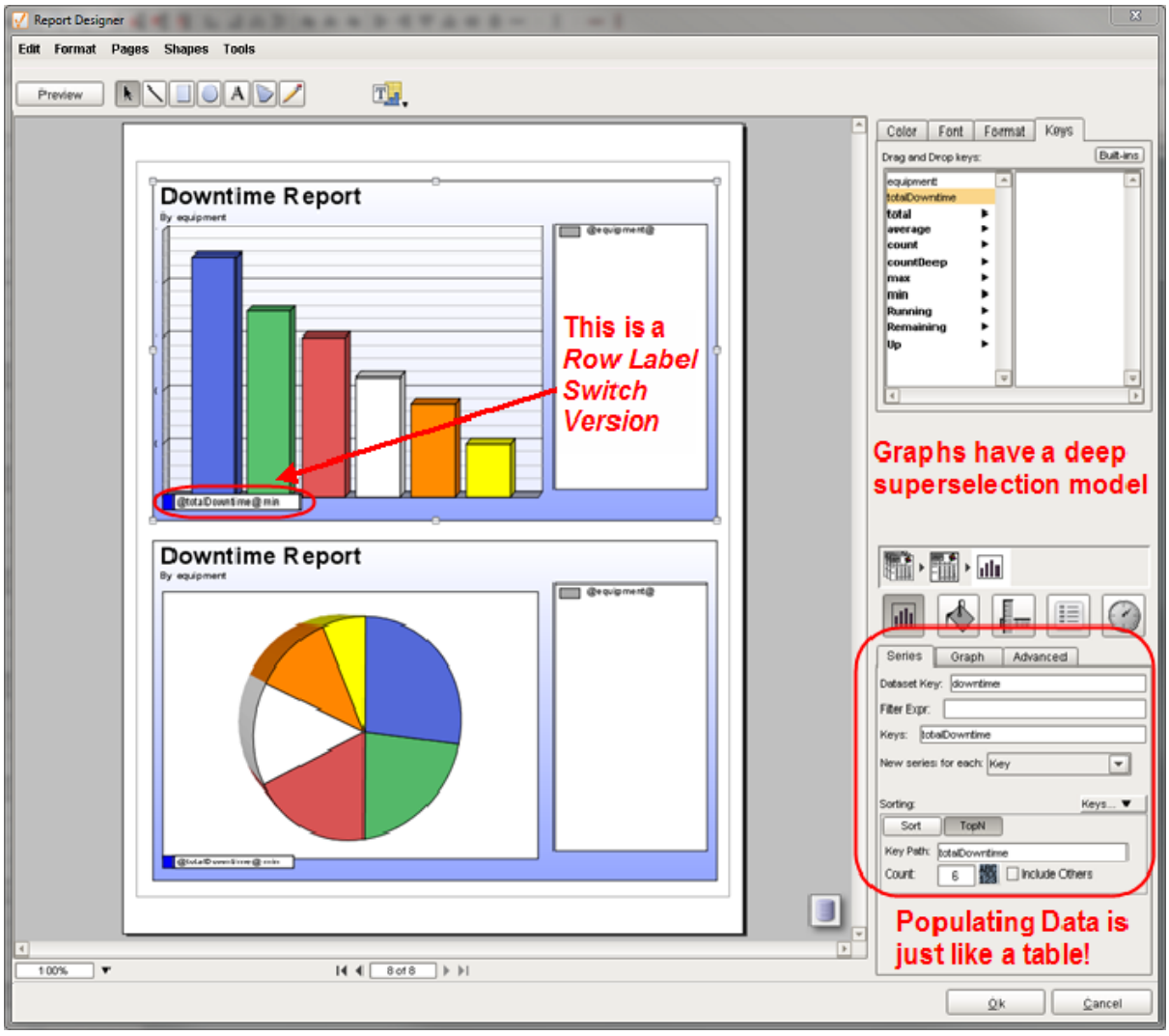
```
equi pment ;
```

equipment	downtime
conveyor line	78
filler	68
labeler	84
palletizer	27



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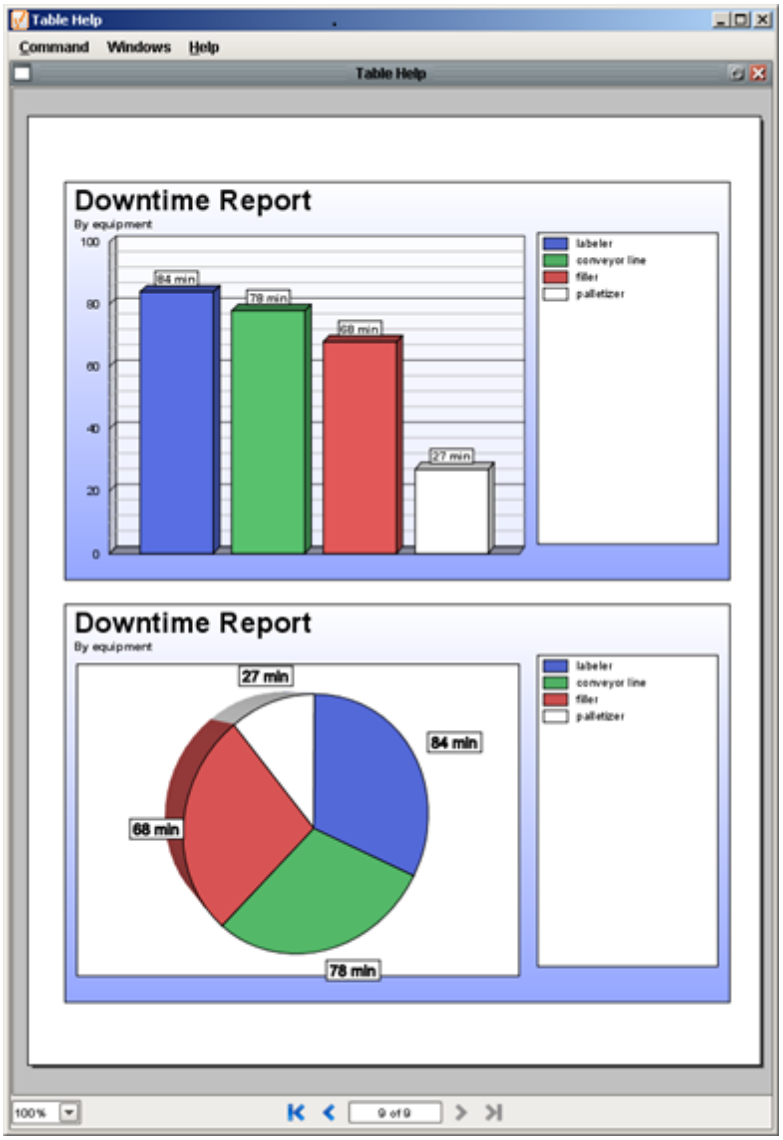

Report in the Ignition runtime

Graph Settings

Basic graph settings can be found on the *Graph* Tab of the graph shape specific inspector .

Graph Menu Item	Function
Graph Type	Choose Bar , Horizontal Bar , or Pie type graph.
Show Legend	Displays a legend object to label series
Show Bar/ Wedge Labels	Builtin graph labels. You may want to rotate them to create space.
Colors:	Drag colors to define graph series colors. Colors will repeat if rightmost color is white.

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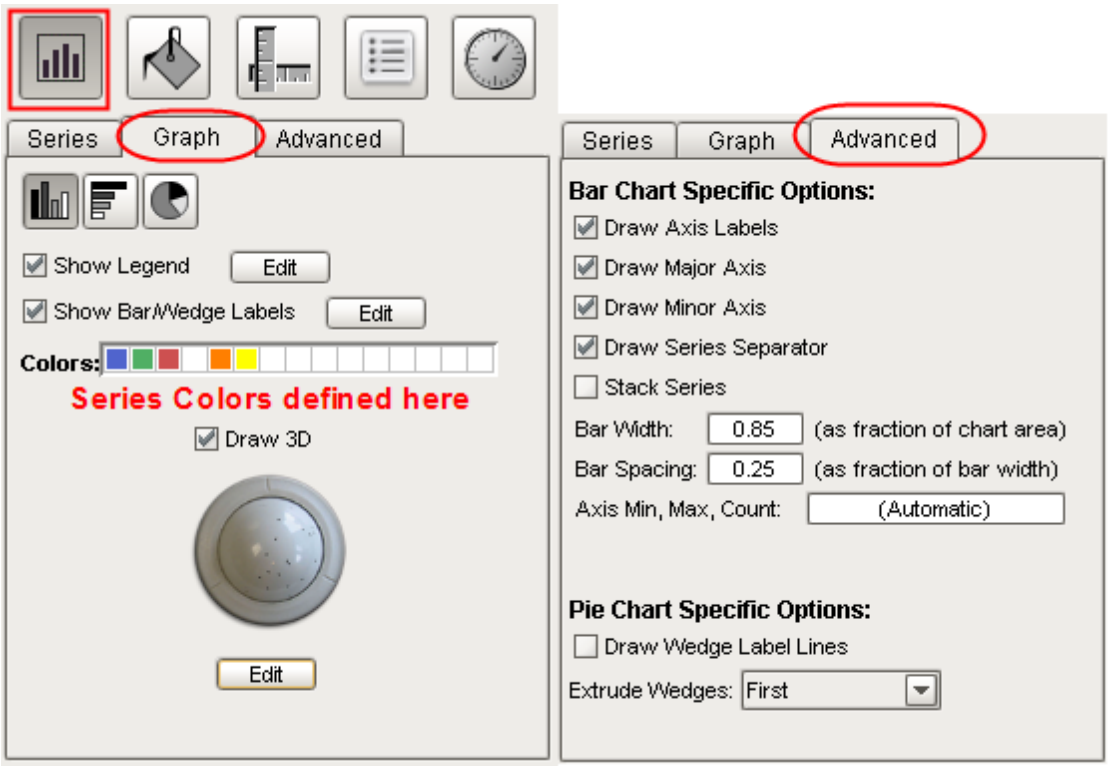
Draw 3D	Render your graph in a three dimensional format.



Embedding Graphs in a table row

Graphs can be embedded in table rows. Leave the Dataset Key blank to have access to the data provided at that level of grouping! This technique is demonstrated in Tutorial #2.

Since a graph is generally a large shape, you usually want to define an explicit page break for the row that contains the graph, so that the graph won't get chopped off on a page boundary. Select the light gray region to the left of the Group in the Table inspector to do this.

Row Label Switch Versions

Row Label Switch Versions are a way to have the graph position labels on each row (Bar in a bar graph, slice in a pie graph). Both examples above use builtin graph labels. The "**Top**" version label on a bar graph will place the label just above the top of the bar on the Y plane for each line. **Middle** and **bottom** work similarly.

You can get to the **switch versions** customizer two ways:

Click on an existing label on the graph. This is illustrated on an image above.

From the graph shape specific inspector, Select the *Graph* tab. Click on **Show Bar/ Wedge Labels**.

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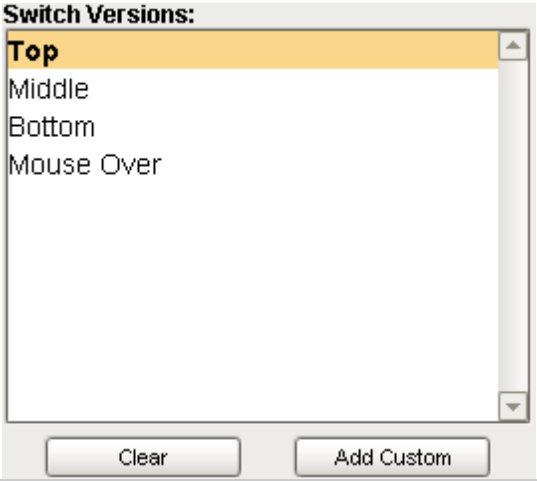

Custom Children

The Graph shape supports additional custom children. Add axis labels or arbitrary text by superselecting the graph and using standard tools such as Text, Rect, Polygon, etc. You can reference keys in added text children which will be evaluated against the group of objects provided for the graph.

TIP	The best way to get the hang of graphs is to create a huge one and experiment with it.

5.8.3.2.4 Line Graph

The *Line Graph* is a DataSet element like the table. It shows a graphical representation of data in the form of a line, area or scatter garph.

Populating data including the concepts of data keys, sorting, and filtering are nearly identical to that of a table.

Example

The Line Graph component is used to display data where the X value is time or numeric, and the Y value(s) are numeric. Lets set up a graph for some timeseries data. Suppose you have a table with data like this:

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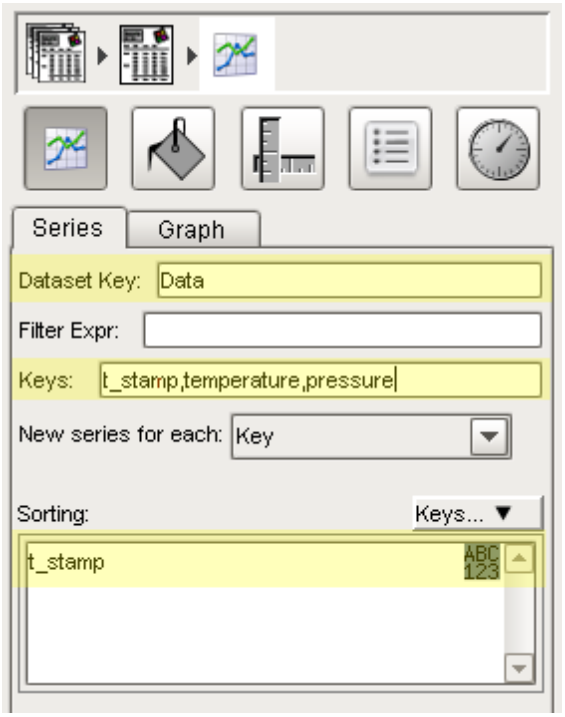
t_stamp	temperature	pressure
2007-03-28 13:22:42	80	74
2007-03-28 13:22:44	89	92
2007-03-28 13:22:46	42	53
2007-03-28 13:22:47	47	35
2007-03-28 13:22:49	86	55
2007-03-28 13:22:51	24	25
2007-03-28 13:22:53	77	68
2007-03-28 13:22:54	30	97

The **t_stamp** column is your X value, and the other columns are your "pens" or series of Y values. You get this data into a report by binding a DataSet property of the report viewer (see Concepts > Basic > Dynamic Properties) to a SQL query, such as `SELECT t_stamp, temperature, pressure FROM graph_data`. Lets say that you had this data in the default **Data** property.

You set up the Line Graph's data the same way you would a Graph or Table. The only trick is that the **keys** needs to be a comma separated list of keys, with the first one being your X value. Lastly, make sure that the data is sorted ascending by the X value. The following setup:



... will produce a line chart like this:

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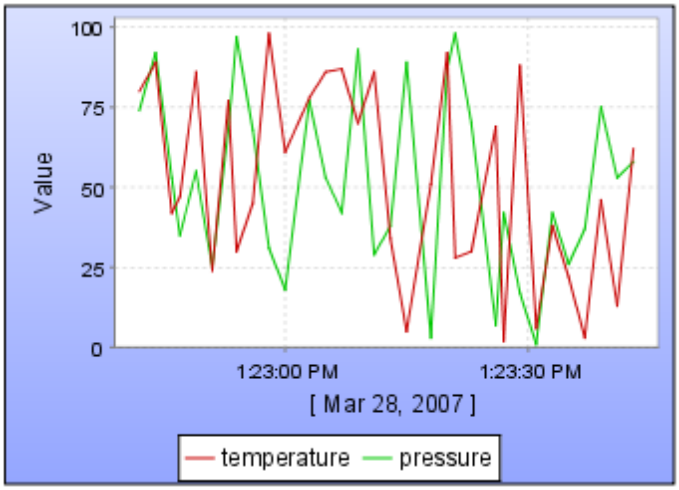

Line Graph Settings

Basic graph settings can be found on the *Graph* Tab of the line graph shape specific inspector.

Graph Menu Item	Function
Graph Type	Choose Line, Area, or Scatter type graph.
Timeseries	If true, the X axis (first Key) should be a date/time. If false, the X axis should be a number.
Show Legend	Displays a legend with the name of each series (each Key besides the first one.
Show Domain Axis	If true, the domain axis (X axis) will be shown.
Domain Axis Label	The label for the domain axis. Date axes may automatically display additional label information to disambiguate certain ranges.
Show Range Axis	If true, the range axis (Y axis) will be shown.
Range Axis Label	The label for the range axis.
Range Axis Min, Max	Leave blank for automatic, or specify a range like **0,100**
Colors:	Drag colors to define graph series colors.

Embedding Graphs in a table row

Graphs can be embedded in table rows. Leave the Dataset Key blank to have access to the data provided at that level of grouping! This technique is demonstrated in Tutorial #2.

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Since a graph is generally a large shape, you usually want to define an explicit page break for the row that contains the graph, so that the graph won't get chopped off on a page boundary. Select the light gray region to the left of the Group in the Table inspector to do this.

5.8.3.2.5 Images

Create images by clicking on the image button on the add shapes button of the toolbar. Double click on an image in the **Image Browser** window.

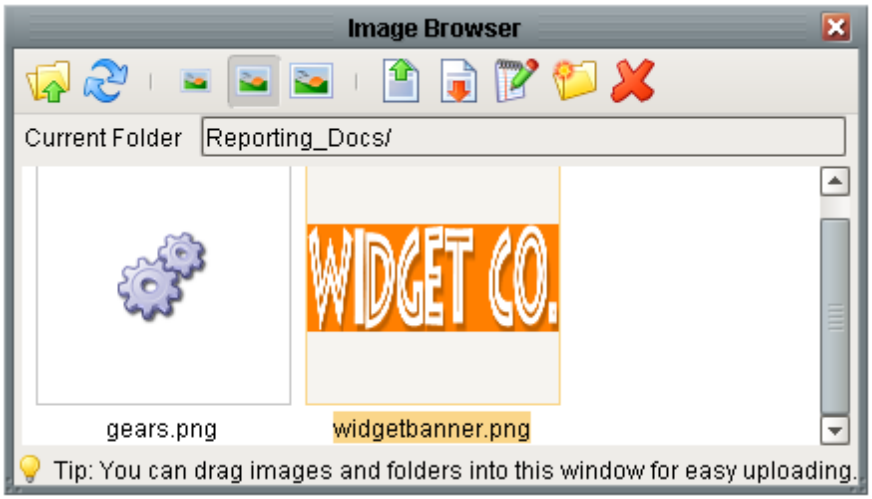

Image Options

Image options are specified in the shape specific inspector for images.

Option	Function
Key	Specify a string expression that returns an image path to change the image. Useful for a multistate image within a table.
Page	Applicable to pdfs only. Selects page number of multipage pdf to display.
Margins	Specifies how many pixels you want of margins around the image.
Style - stretch	Stretches the picture to the image object's size, regardless of aspect ratio.
Style - tile	Tiles the original sized picture within the image object, cutting off sides as necessary.
Style - fit	Resizes picture to image object maintaining aspect ratio.
Style - fit if needed	Resizes picture to image object maintaining aspect ratio, shrinking if necessary, but never enlarging.
Size borders to image	Applicable to **fit** and **fit if needed**.
Rounding Radius	Turns stroke (border) from rectangle, to rounded rectangle, to circle as the number is increased.

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Image Placeholders

Images can be populated with BLOB data from an SQL database. They are referred to as *Image Placeholders* when used in this fashon. Simply define the **Key** to the Blob image.

Dept Image	First	Last	Department
	Joe	Blogs	ADMIN
	Julia	Hinderson	ENGINEERING
	Adam	Blackwell	ENGINEERING
	Robert	Hill	SALES
	Brian	Green	ADMIN
	Elaine	Short	SALES
	Tim	Moore	ENGINEERING

Using an *Image Placeholder* and blobs to dynamically illustrate table row based on **department**.

Using Adobe Acrobat (PDF) files

Pdf files are typically used when you have an existing report that you wish to create dynamically. Simply drag text labels or even tables on the pdf to generate a "filled in" report.

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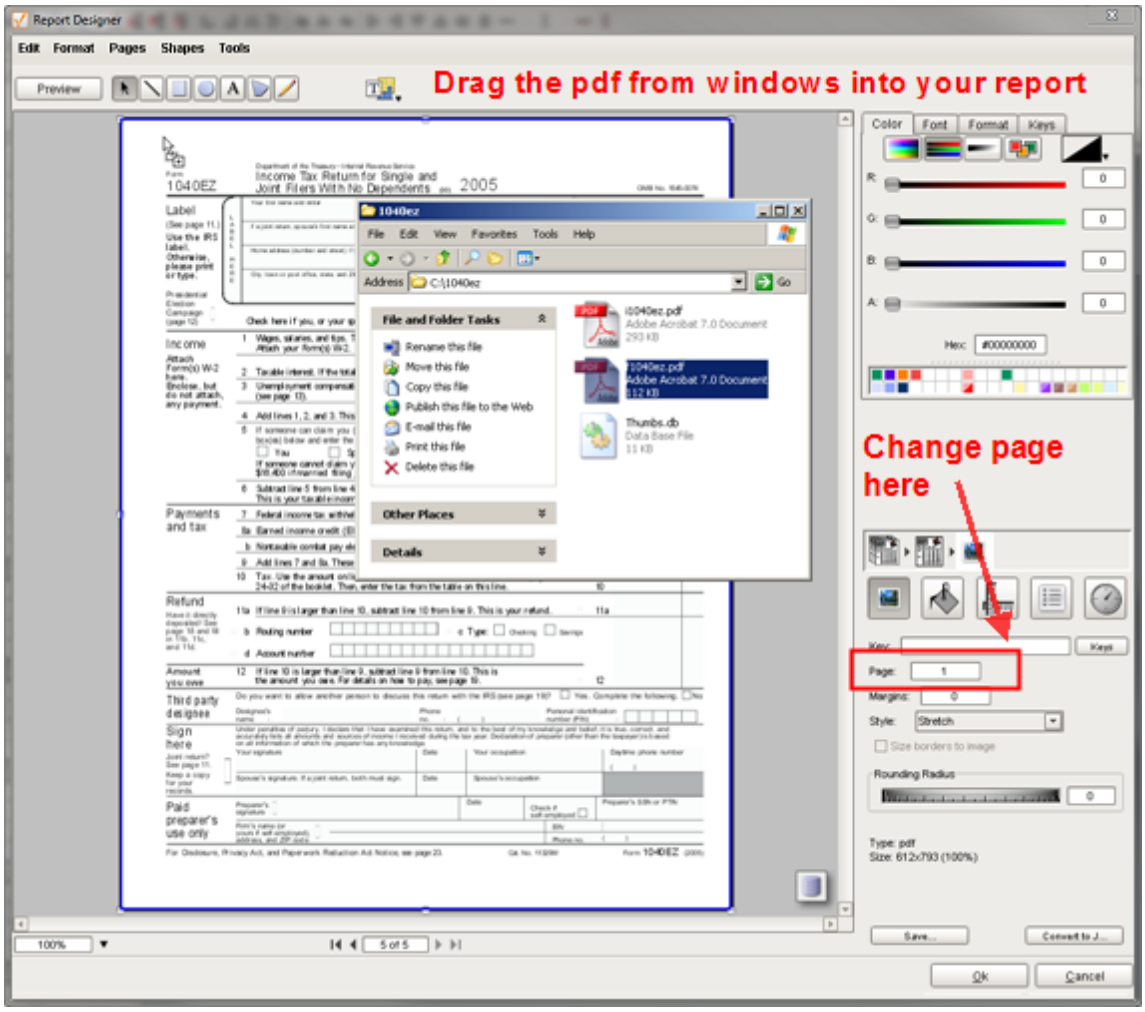

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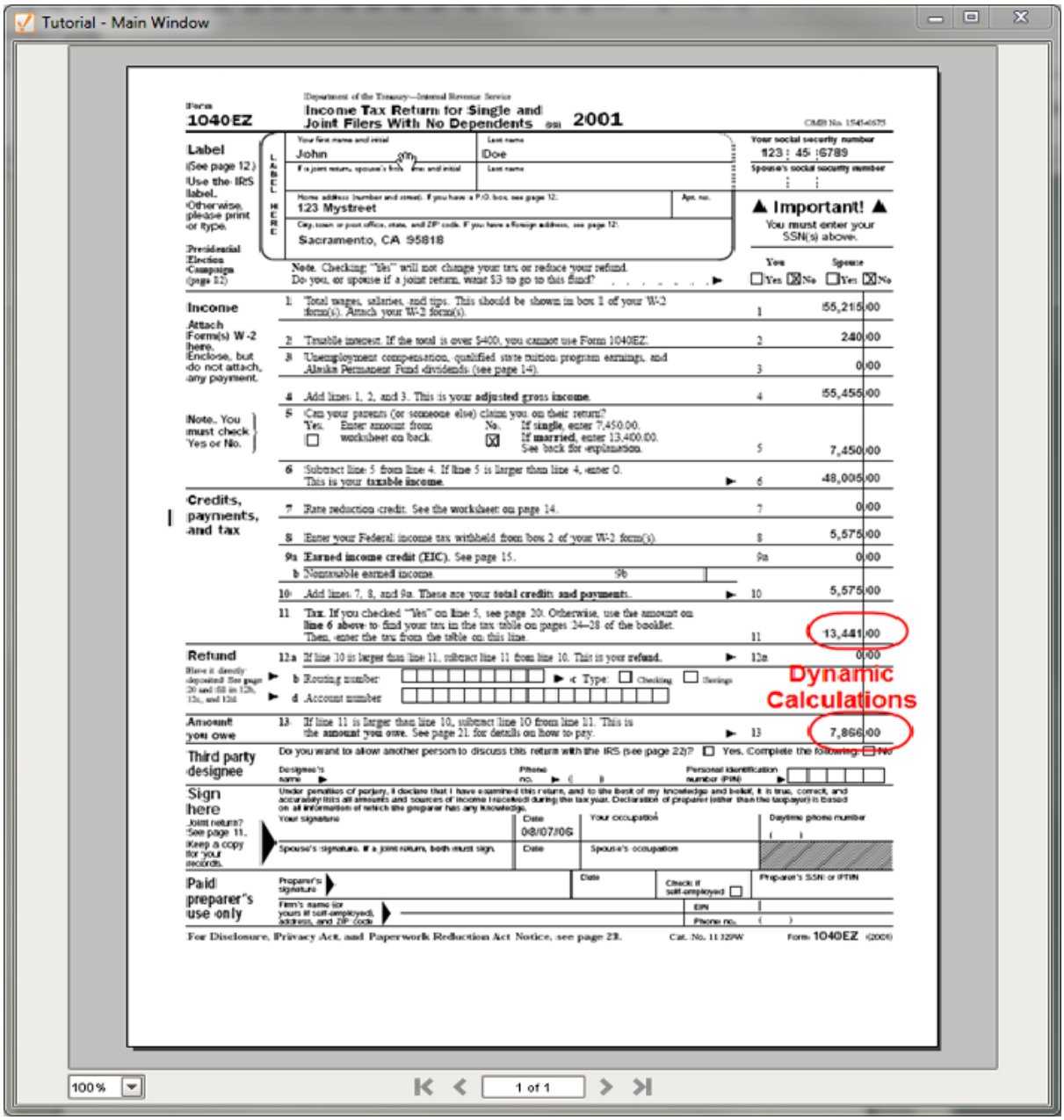
Tutorial - Main Window
Form 1040EZ
Income Tax Return for Single and Joint Filers With No Dependents 2001
Dynamic Calculations
100%
1 of 1

A filled out pdf report

TIP	Extract only the pdf pages that you are going to use before putting them into your report.

5.8.3.2.6 Labels

Labels can be used to print out mailing labels, create name tags, or any other generic labels. You can use standard Avery label sheets or specify your own dimensions.

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Shape Specific Inspector Item	Function
List Key	Name of DataSet that will populate the labels
Avery Product Number	Choose from a list of Avery Label Formats
Rows/Columns	Defines the number of rows and columns on the page
Label Width/ Height	Width and height of labels in pixels
Spacing Width/Height	Distance between labels on the page in pixels
Sorting	Specifies printing order. Works the same as table sorting.
Paginate	Two setting (Off ☐ or On ☑) option that determines whether or not to use page breaks. Broken are useful for pdf files, continuous are good for Flash or CSV. Typically leave this alone.

Example

1. Create labels from tool bar or by dragging a DataSet to the report.
2. Specify the DataSet name (*employees*) as the List Key in the shape specific inspector
3. Choose the appropriate Avery Product number or manually specify dimensions
4. Create text labels. Set up your labels with substitution keys

Employee addresses can be retrieved from the database with the following SQL query:

```
SELECT e.first, e.last, a.address, a.city, a.state, a.zip FROM employees e, address a WHERE e.id=a.emp_id;
```

first	last	address	city	state	zip
Joe	Blogs	1234 Mystreet	Sacramento	CA	95818
Julia	Hinderson	237 Winding Way	Carmichael	CA	95715
Adam	Blackwell	779 Elm Street	Sacramento	CA	95833

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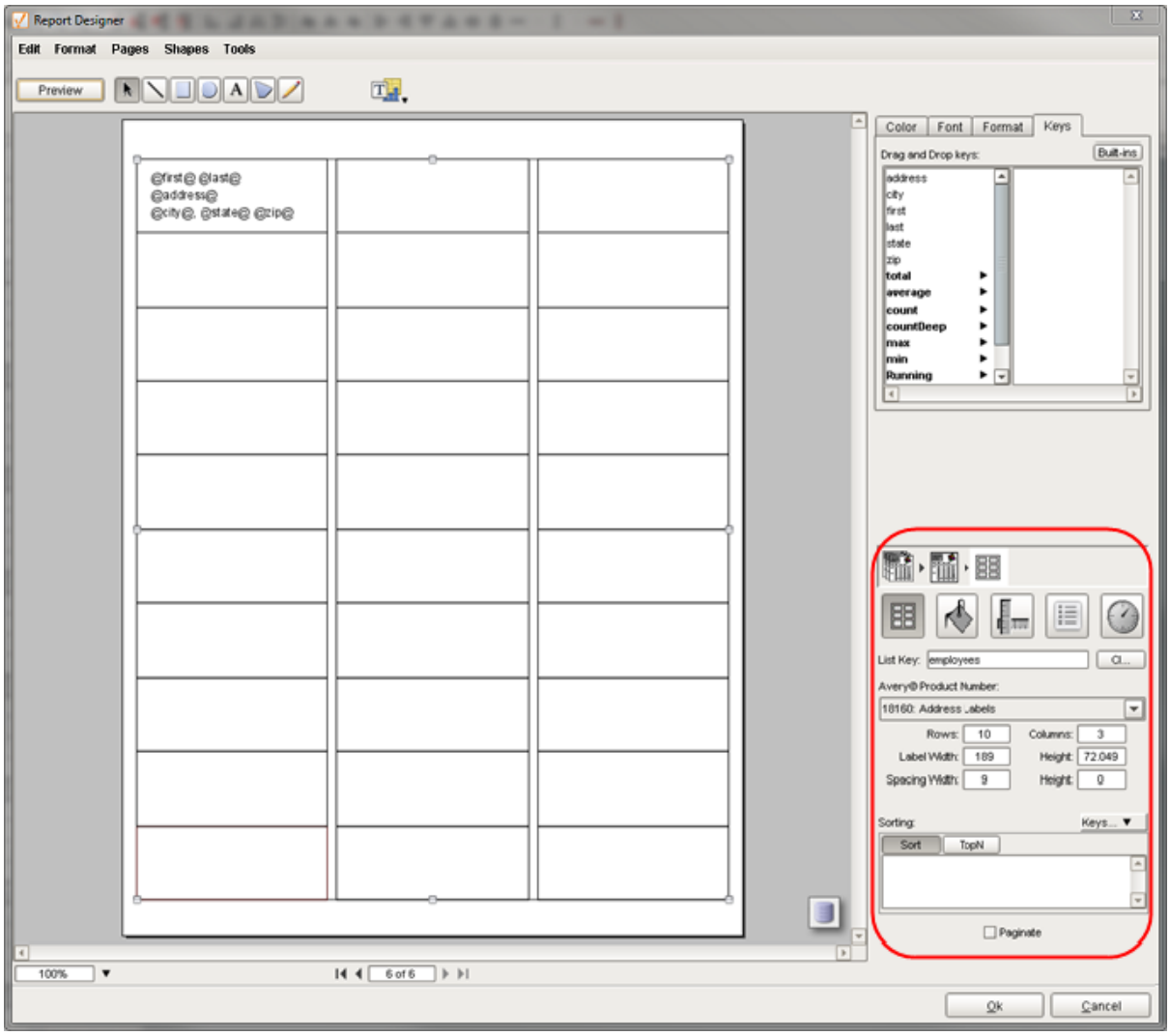

Joe Blogs
1234 Mystreet
Sacramento, CA 95818

Julia Hinderson
237 Winding Way
Carmichael, CA 95715

Adam Blackwell
779 Elm Street
Sacramento, CA 95833

Resulting Output

5.8.3.2.7 Barcode

Description

The reporting barcode component is identical to Ignition's normal barcode component. It displays some text encoded as a barcode, and also displays the text verbatim below the

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barcode. In the report designer, you can drag a data key into the text box, and the barcode will be dynamic just like any other reporting component.

Properties

Value

The value (code) that will be encoded as a barcode. Acceptable values vary depending on the encoding type. Drag a data key (Like `@SerialNum@`) into the value box to make the barcode dynamic.

Type

The encoding type of the barcode. Types are<

Code 39

Code 39 Narrow

Extended Code 39

Extended Code 39 Narrow

Code 128

Codabar

Codabar Narrow

Interleaved Code 25

Interleaved Code 25 Narrow

MSI

EAN 13

EAN 8

Bar Width

The width of a single bar.

Bar Height

The height of all bars.

5.8.3.2.8 Simple Table

The *Simple Table* is a table of a fixed size that does not have a dataset key. It has an intuitive superselection model.

Property	Function
Rows	Specify number of rows
Columns	Specify number of columns
Header Row	Optional Header Row

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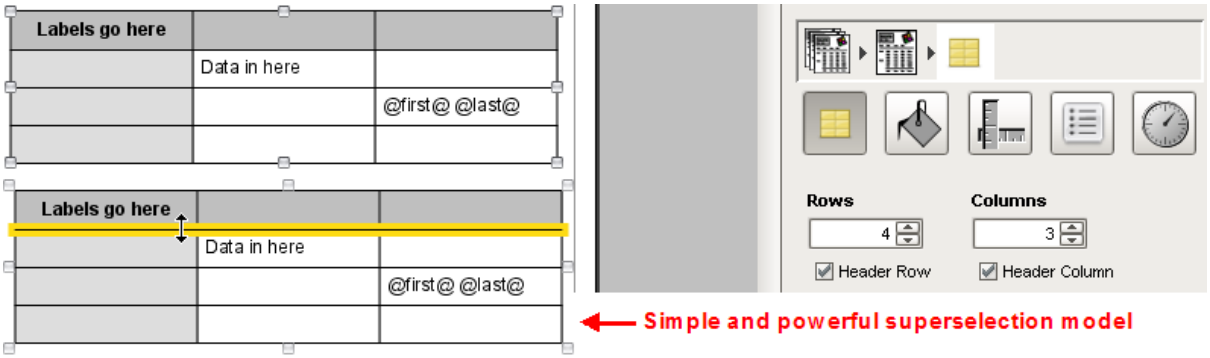
Header Column	Optional Header Column



Note: **@first@** will not resolve to anything because there is not an implied dataset key. You would need a full path such as **@employees[0].first@** (unless you have the dynamic non-DataSet property, *first*).

5.8.3.2.9 Tables

Tables are objects that display data in a structured, repetitious format. Their complexity can range from trivially simple to complicated. The Reporting engine will automatically create new pages to fit all data within the table's boundaries. Combine that feature with powerful data manipulation and layout tools, and you get an object that often forms the basis of your reports.

A Simple Table

Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

A Complex Table

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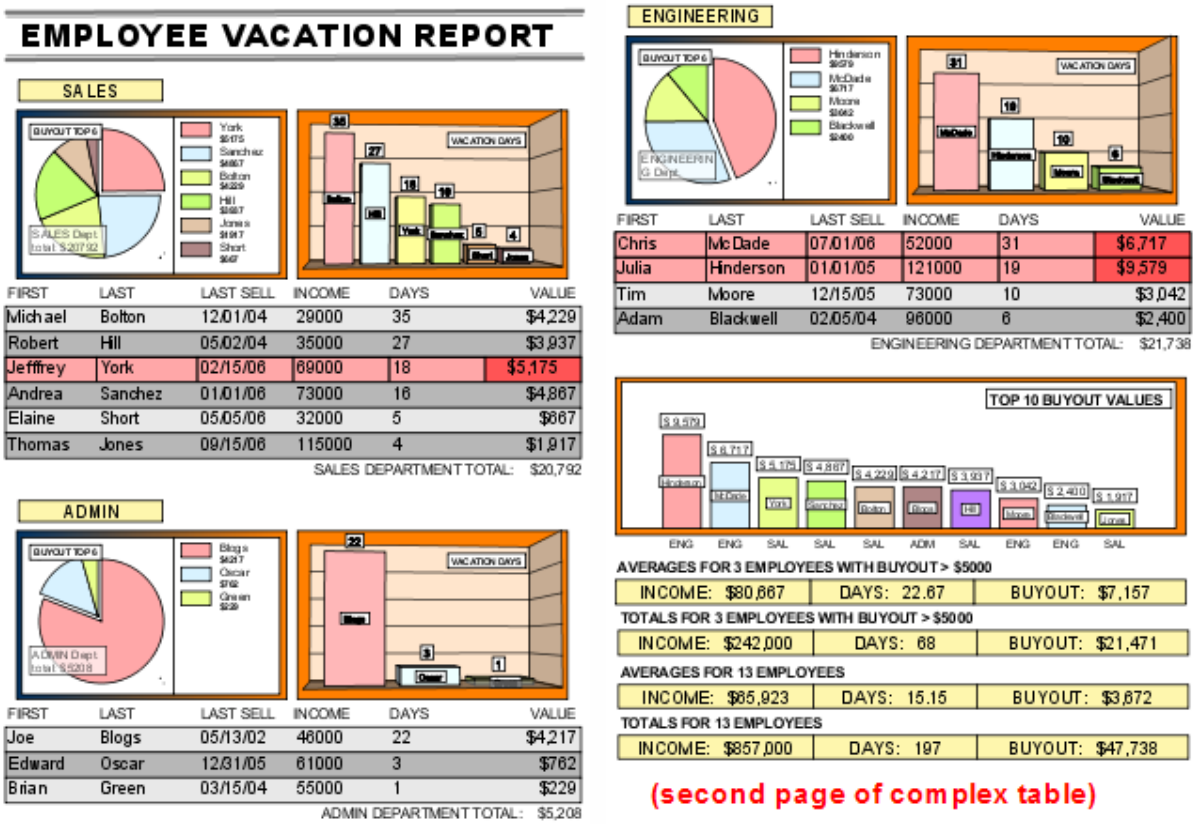

EMPLOYEE VACATION REPORT

SALES

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Michael	Bolton	12/01/04	29000	35	$4,229
Robert	Hill	05/02/04	35000	27	$3,937
Jefffrey	York	02/15/06	69000	18	$5,175
Andrea	Sanchez	01/01/06	73000	16	$4,867
Elaine	Short	05/05/06	32000	5	$867
Thomas	Jones	09/15/06	115000	4	$1,917

SALES DEPARTMENT TOTAL: $20,792

ADMIN

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Joe	Blogs	05/13/02	46000	22	$4,217
Edward	Oscar	12/31/05	61000	3	$762
Brian	Green	03/15/04	55000	1	$229

ADMIN DEPARTMENT TOTAL: $5,208

ENGINEERING

FIRST	LAST	LAST SELL	INCOME	DAYS	VALUE
Chris	McDade	07/01/06	52000	31	$6,717
Julia	Hinderson	01/01/05	121000	19	$9,579
Tim	Moore	12/15/05	73000	10	$3,042
Adam	Blackwell	02/05/04	96000	6	$2,400

ENGINEERING DEPARTMENT TOTAL: $21,738

TOP 10 BUYOUT VALUES

AVERAGES FOR 3 EMPLOYEES WITH BUYOUT > $5000

INCOME: $80,667	DAYS: 22.67	BUYOUT: $7,157

TOTALS FOR 3 EMPLOYEES WITH BUYOUT > $5000

INCOME: $242,000	DAYS: 68	BUYOUT: $21,471

AVERAGES FOR 13 EMPLOYEES

INCOME: $85,923	DAYS: 15.15	BUYOUT: $3,872

TOTALS FOR 13 EMPLOYEES

INCOME: $857,000	DAYS: 197	BUYOUT: $47,738

(second page of complex table)

The above table was created in Tutorial #2. It uses the following features:

- Header, detail, and summary rows
- Grouping
- Sorting
- Row Versioning

Next (Table Basics)

TIP	Table related help sections can be referenced independently, but will be written so that examples follow sequentially.

5.8.3.2.9.2 Basics

Let's go through the process of creating a simple table! We will cover: getting data into the report, creating a table, defining data, and explore basic parts. Make sure you understand how the Dataset key defines the table's DataSet.

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Date	Equipment	Downtime	User entered comment
Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

Summary goes here

Resulting Basic Table

Getting data into the report

Before creating a useful table, you must get the data from the SQL database into the Report Viewer.

Example downtime data can be retrieved with the following SQL query:

```
SELECT * FROM downtime;
```

downtime_ndx	t_stamp	equipment	time	comment
1	2005-12-20 17:55:00	labeler	50	Out of labels
2	2005-12-22 11:55:00	filler	15	Scheduled maintenance
3	2006-01-02 22:55:00	palletizer	10	Misalignment
4	2006-01-03 02:55:00	conveyor line	25	backup
5	2006-02-12 06:13:00	labeler	10	
6	2006-02-12 12:01:00	labeler	3	Out of labels
7	2006-02-12 14:01:00	palletizer	17	Misalignment
8	2006-02-12 16:23:00	conveyor line	23	Scheduled maintenance
9	2006-02-12 20:04:00	filler	33	Overflow
10	2006-02-12 20:13:00	labeler	21	Stuck labels
11	2006-02-12 20:25:00	filler	20	Overflow
12	2006-02-12 20:36:00	conveyor line	30	Scheduled maintenance

Populate the Report Viewer's default dynamic dataset, *Data*.

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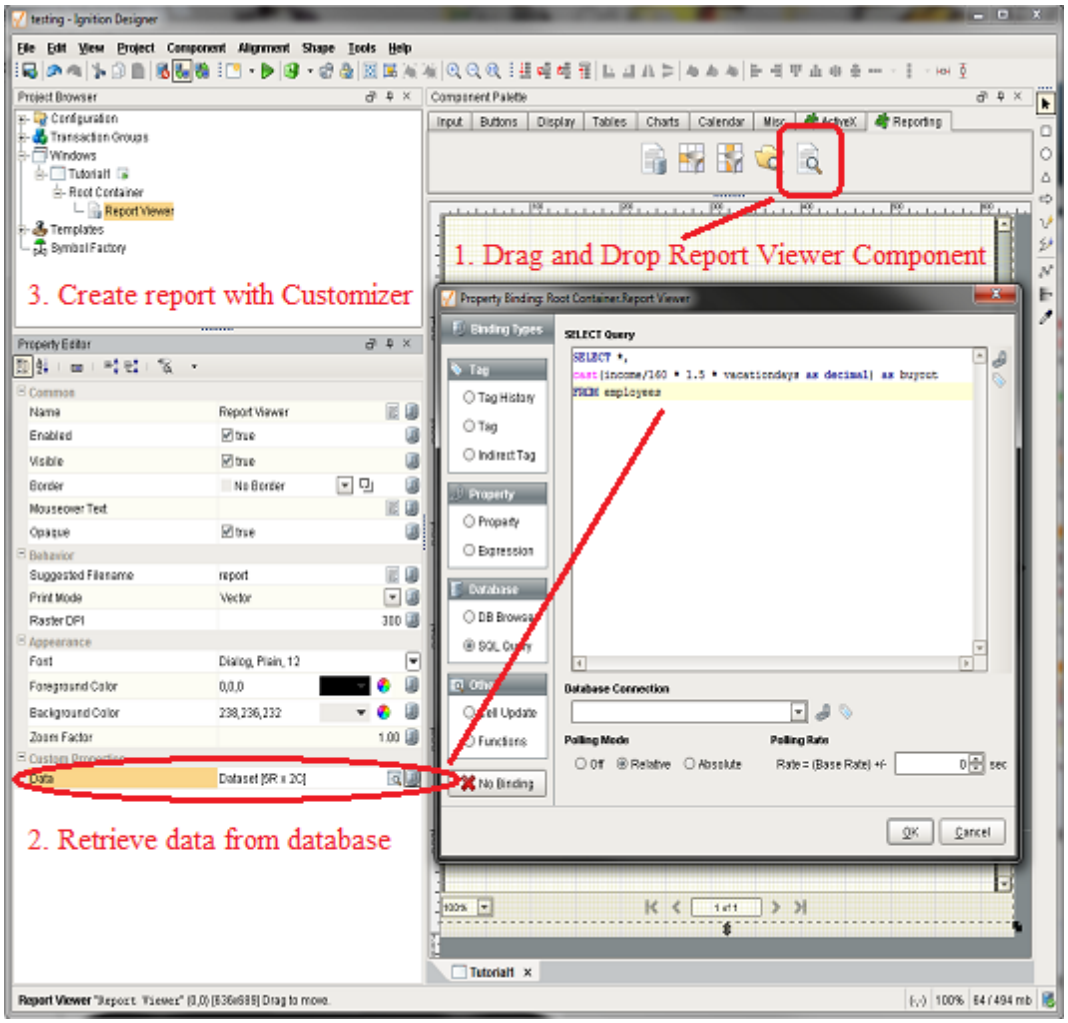

(Illustration from Tutorial #1).

Your report now has data. You're ready to create a table!

Creating a Table

1. Open the Report Designer by selecting the Report Viewer in the Ignition Designer and applying the customizer (Cntl+U).
2. Click the table icon on the add shapes button of the toolbar.
3. Size and position table as desired.

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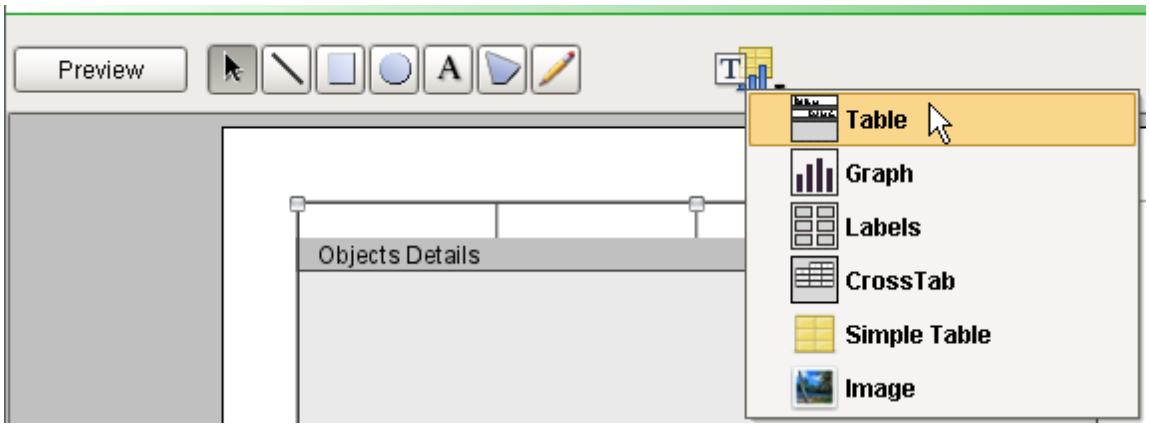
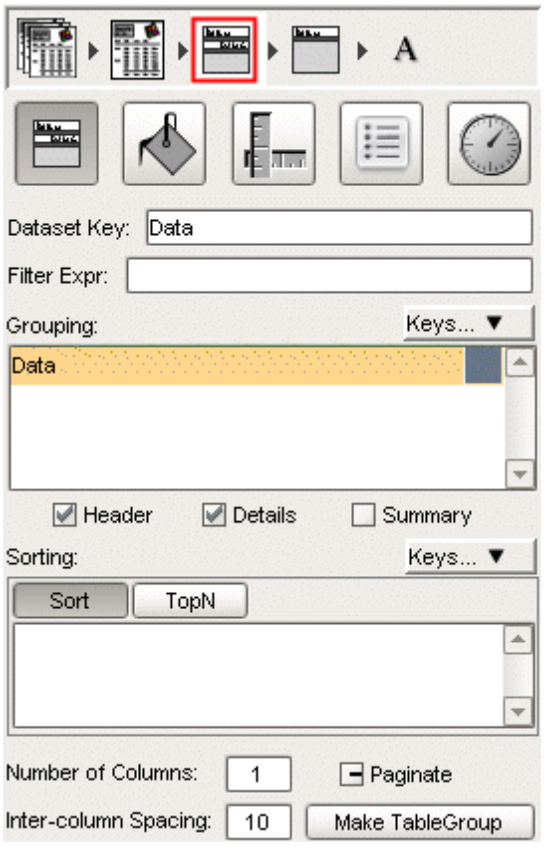


Defining Data

The **Dataset Key** is the name of the DataSet that a table or graph is getting its input from. *@yourSubstitutionKey@* in the table with a defined Dataset key will work as if it were *@DataSet_Key.yourSubstitutionKey@*

1. Click the table to select it
2. Select the Table Inspector



3. Under **Dataset Key:**, type *Data* or drag the *Data* DataSet from the Keys Attribute Panel, choose **table** and click ok. This is the step that defines which DataSet this table will use. You may only define one per table. If you created the table by

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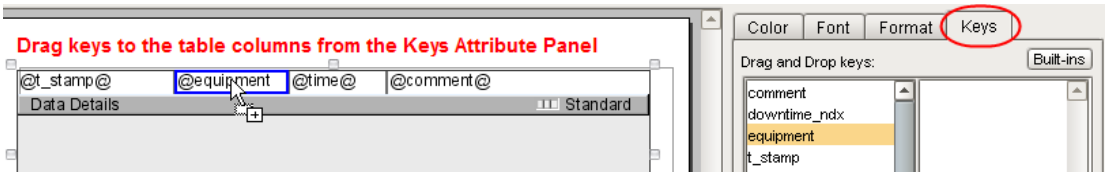
dragging the DataSet, you will not need to fill in the **DataSet Key** in the next section.

With a defined dataset key, your table can reference that data without explicitly defining the path. For example, in this table, **@Data.comment@** is the same as **@comment@**.

4. Drag Keys to the table columns from the Keys Attribute Panel. We appended the string "minutes" to the time label and formatted the date.



5. Click Preview to view your table.

Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

6. Click "Header" and "Summary" check boxes in the Table Inspector. Add text labels to Header and Summary.
7. Select **Data Header**, add a Fill Color (Background) in the Fill & Stroke Inspector.
8. Select **Data Details**, add a Stroke Color (Outline) in the Fill & Stroke Inspector.
9. Adjust text, fill, and stroke as desired.
10. Click Preview to view your table.

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Date	Equipment	Downtime	User entered comment
Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

Summary goes here

Anatomy of a Table

There aren't many parts to a table.

You have the entire table to define the region on the report that the table occupies. Much area of simple tables often end up as a placeholder.

Header, detail, and summary rows are optional for each level of Grouping.

The Table Inspector and Table Row Inspector are where table configuration occur.

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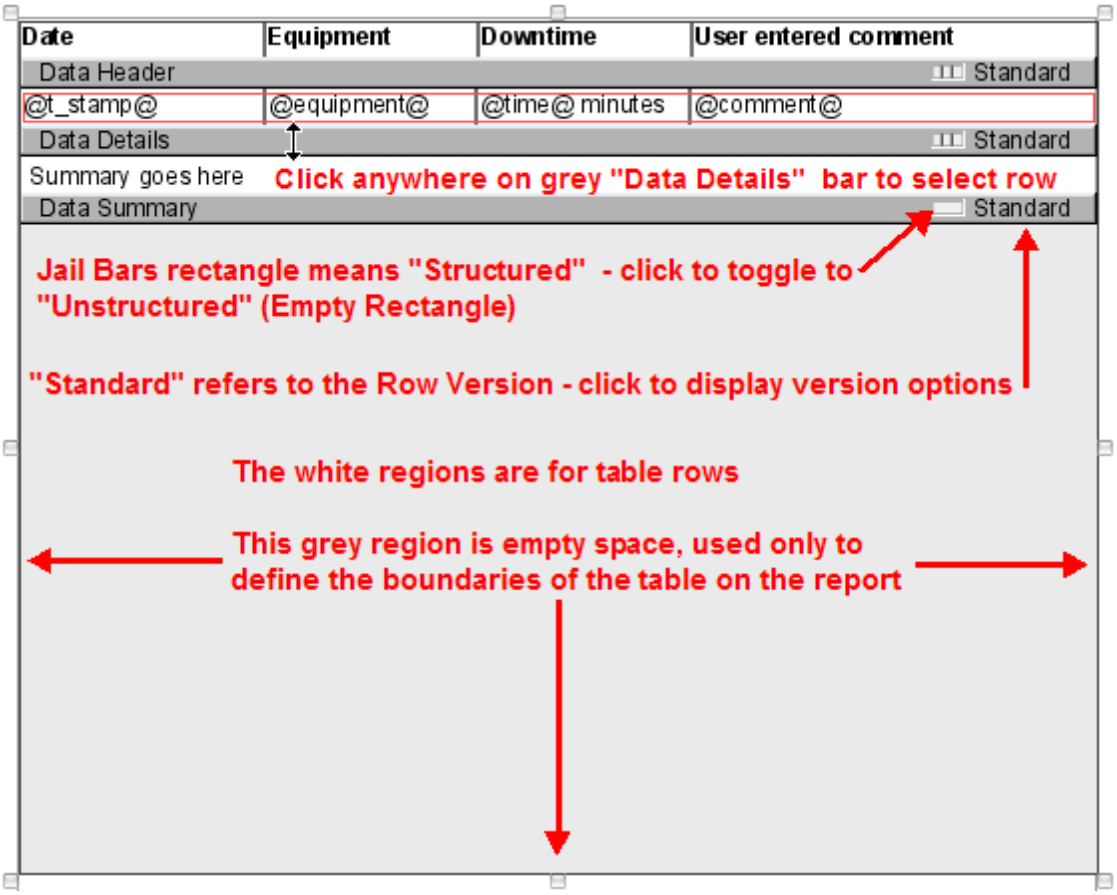
Date
Equipment
Downtime
User entered comment
Data Header
Standard
@t_stamp@
@equipment@
@time@ minutes
@comment@
Data Details
Standard
Summary goes here
Click anywhere on grey "Data Details" bar to select row
Data Summary
Standard
Jail Bars rectangle means "Structured" - click to toggle to "Unstructured" (Empty Rectangle)
"Standard" refers to the Row Version - click to display version options
The white regions are for table rows
This grey region is empty space, used only to define the boundaries of the table on the report

Previous (Table Overview) Next (Table Rows)

TIP Tables can also be created by dragging a DataSet to your report. This will automatically set the **Dataset Key**.

5.8.3.2.9.3 Table Rows

Rows are an important fundamental aspect of tables. The different types of rows can be independently enabled for each level of Grouping. Table Row Versioning gives you the option of conditionally displaying rows with a different format.

Header Row

The header row is used to add such report features as column labels. An interesting feature of the header is reprint versioning, which allows a different header on every page after the first. The main data in a table has one header row. Each subgroup of data can have its own row header.

With grouping, the "top" level **Header** is the first row for the entire report. Lower level **Headers** fall immediately below higher level **Details**. In many cases where one is used,

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the other could be used equivalently in its case.

Detail Rows

The detail rows typically represent the majority of the data on a table or the "middle" rows. You might disable detail rows in unusual situations such as only displaying aggregate summaries in a grouped report.

With grouping, the **Detail** rows appear below the same level **Header** and above the **Header** of the next level.

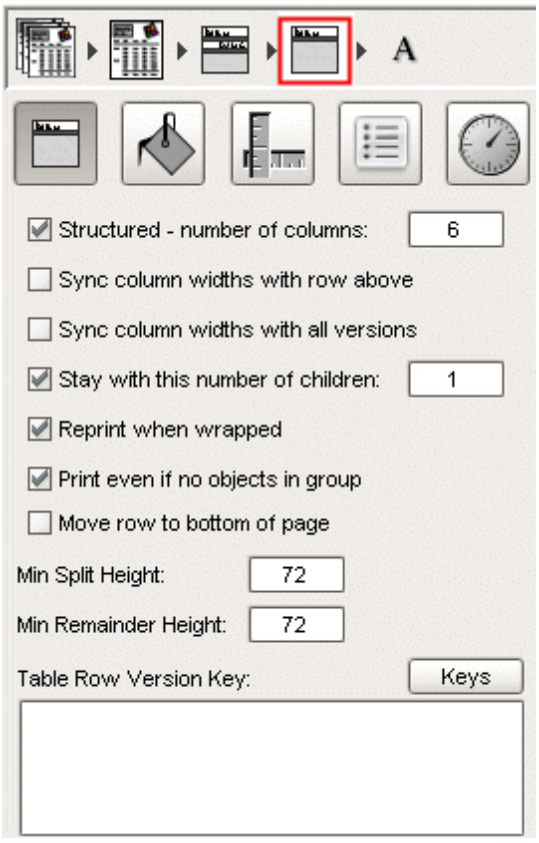
Summary Row

The summary row works like the header row. It prints at the bottom of the table.

With grouping, **Summary** rows are always last, always in the opposite order of the **Headers**.

Row Properties

Row properties are defined in the Table Row Inspector.



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Row Precedence Example

Suppose you have a table with the following levels of grouping: First, Middle, Data. *Data* is your main DataSet, first and middle are strings (or numbers). The following is the order of grouping:

Group	Section
First	**Header**
First	**Details**
Middle	**Header**
Middle	**Details**
Data	**Header**
Data	**Details**
Data	**Summary**
Middle	**Summary**
First	**Summary**

Previous (Table Basics) Next (Table Row Versioning)

TIP Table Row Versioning allows any given row to use different constructions based on an expression. This gives you options like: alternating row background color, emphasizing alarm states, and conditionally displaying different information in general.

5.8.3.2.9.4 Sorting and Filtering

Sorting orders your data by a key or list of keys. Filtering excludes data based on some condition. Both are done in the table inspector.

Sorting

There are two similar methods of sorting. They can be ascending ( ) or descending ( ) and can use aggregate keys.

Sort takes a list of keys and sorts by the first one. In the event of a tie it goes down the list.

TopN uses a single key path. The **Count** option allows a limit to the number of rows processed.

Filtering

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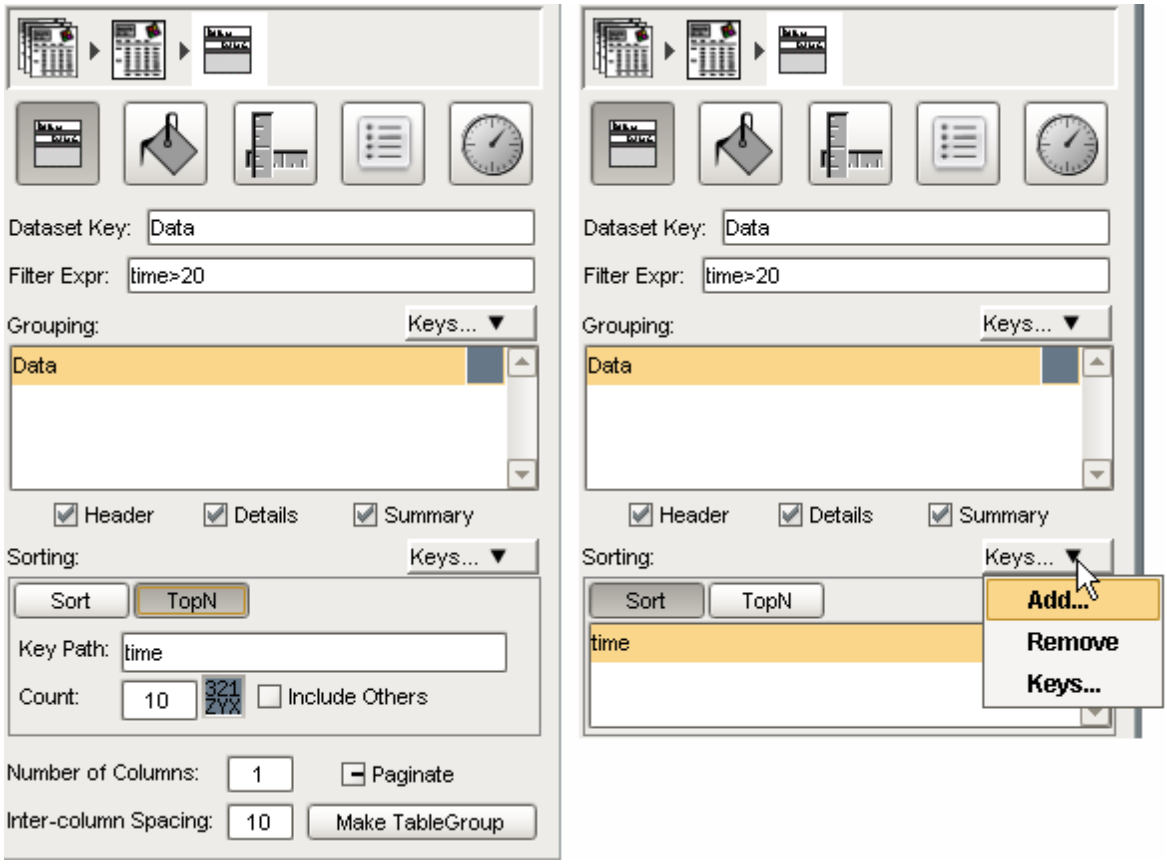
Filtering gives the option of processing data based on an expression. If the expression resolves false, the row will be skipped. Note: you do not need @ symbols to reference keys.

Example



Date	Equipment	Downtime	User entered comment
Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels

Total Downtime 182 minutes

This example is sorted descending by downtime and filtered by downtime greater than 20 minutes.

Previous (Table rows) Next (Rows Versioning)

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TIP	The term *processed* is used instead of *displayed* because **TopN** and **Filtering** work with aggregate functions. Filtered data is treated as if it didn't exist.

5.8.3.2.9.5 Row Versioning

Row versions allow you to conditionally display rows of data in different format. They are used to make certain data stand out or to make your report more legible.

Row versions are either builtin or user defined and may be specified with a version key expression. They are applicable to header, detail, and summary rows

Builtin Row Versions

By default reports use the **Standard** row version. Here are the builtin row versions:

Built in Version	Description
Standard	Default row version
Alternate	Applies every other row. Good for grey-bar reports by changing the background color.
Reprint	Applies every page after the first. Good for one time headers or (continued) indications to save space.
First Only	Applies only to the first instance of the row. Good for showing header information without using an upper level detail row.
TopN	Applies to **count** number of rows in a **TopN** sort. Using "include others" will then distinguish between **TopN** and non-**TopN** rows.
Split Header	Applies to headers that has been split due to excessive height. Good for providing "Continued" type indicators.
Running (Footer)	Provides a different footer row for a table whose data extends to the next page.
Mouse Over (N/A)	Used for interactive highlighting in flash based reports. (Not applicable at this time).

User Defined Row Versions

User defined row versions are identified by a string based name. They will be used when the Row Version Key expression is a string that matches the row version name.

Row Version Key

The *Row Version Key* is an expression that must return a string. If that string equals the name of a row version, either builtin or user defined, that version will be used. An invalid string will default back to normal builtin row version behavior.

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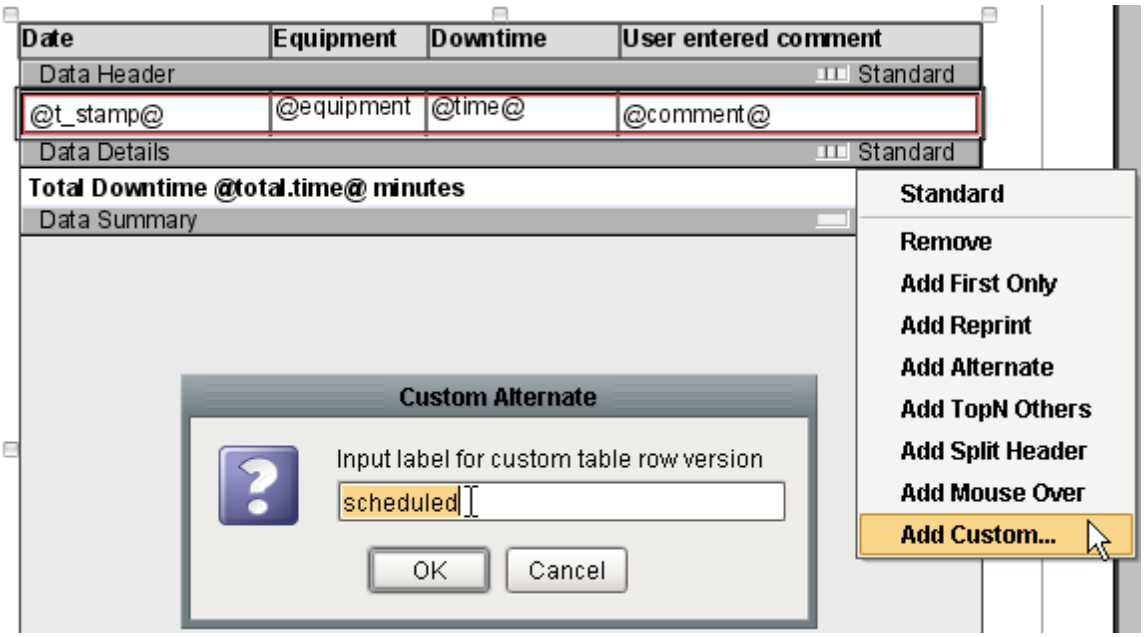
Example

1. Add a custom row version. *scheduled*, in this case.
2. Select your row and customize it
3. Specify **Table Row Version Key**. Tip: start with the expression "scheduled" to try out your custom row version before using more complex expressions. In this case we use: IF comment = "Scheduled maintenance" THEN use our custom row version.

TIP	When using an IF condition for row versioning leave out the ELSE. Your table will then still respect builtin row versions. If you defaulted the ELSE to "Standard", none of the builtin versions such as *Alternate* would ever appear.



Add a custom row version

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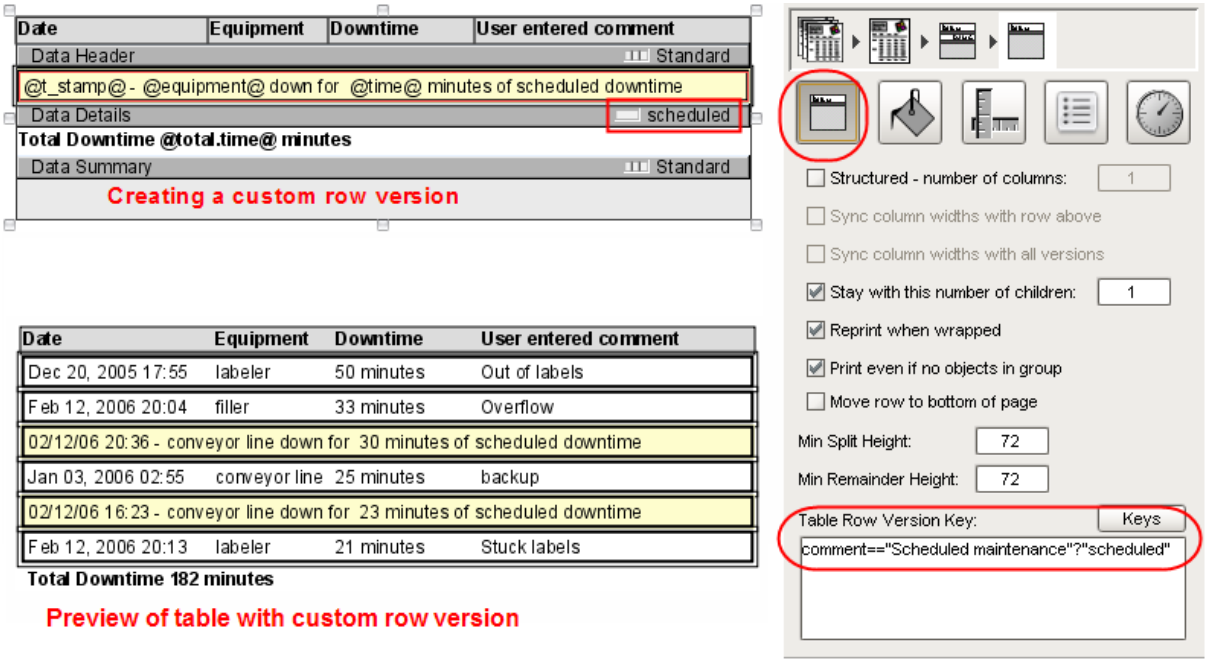

Previous (Table sorting) Next (Table grouping)

TIP Make sure that you're happy with the *Standard* row version before you create other row versions. This will save you time as other versions begin as a copy of *Standard*.

5.8.3.2.9.6 Grouping

Grouping breaks tables down by keys that share a common value. Tables support an arbitrary level of groups. Each can have its own header, detail, and summary rows. Additionally, totals and other aggregate functions are supported for any level of grouping.

See Table Rows for specifics on row precedence with grouped tables.

Example

This example begins with the Table Basics example. We'll group our existing downtime report table by equipment.

1. Drag the *equipment* key into the grouping table inspector.
2. Check header, detail, and summary to enable all.
3. Add headers and details.
4. Use **@total.time@** for both summary rows. Notice that the **total** respects grouping.

   In the **equipment Summary** row *total.time* is a sum of all time at that level of

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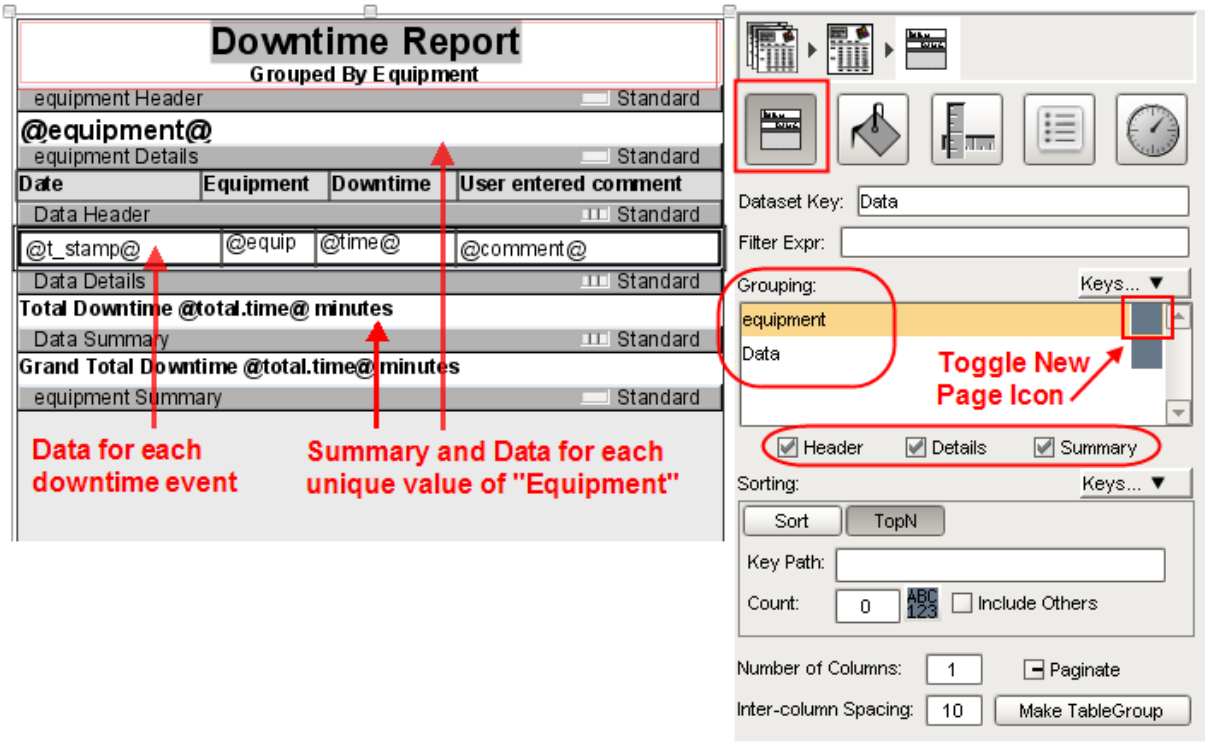
grouping, which includes **all** downtime events. In the **Data Summary** row *total.time* is a sum of all downtime at that level of grouping, total time that has already been grouped by equipment, equivalently, total downtime by equipment.



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Downtime Report

Grouped By Equipment

labeler

Date	Equipment	Downtime	User entered comment
Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 06:13	labeler	10 minutes	scheduled
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels

Total Downtime 84 minutes

filler

Date	Equipment	Downtime	User entered comment
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance

Total Downtime 68 minutes

palletizer

Date	Equipment	Downtime	User entered comment
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment

Total Downtime 27 minutes

conveyor line

Date	Equipment	Downtime	User entered comment
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance

Total Downtime 78 minutes

Grand Total Downtime 257 minutes

Separating Groups with new pages

Clicking on the gray box of a particular level of grouping on the **grouping** panel of the table inspector will change the icon from the *default icon* to the *New Page* icon . Each new instance of that level of grouping will create a new page in the report.

In the example above, separating the *equipment* level of grouping by page would create separate report pages for the following: labeler, filler, palletizer, and converyor line.

Previous (Table Row Versioning)

Tip	Double Clicking a key while a table is selected will add that key to the grouping list and add it as a table row.

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5.8.3.2.9.7 Table Groups

Table Groups

Table groups allow you to specify child tables for each object in the master list (using a list key found in each of those objects). It also allows you to specify additional "peer" tables that pick-up exactly where the first table ends (note: multiple tables can also be configured as multiple- page templates, providing a page break between tables).

Use

To turn a table into a table group, simply select the table and click the "Group in Table Group" button in the table inspector. The table is actually a child of a "Table Group" element, which has it's own inspector.

Now you can drag any list key of the master table into the table group's table tree to add a child table (the Table Group pull-down menu also provides a way to add child or peer tables). This will add a whole new table for this "child" list key. You can edit each of the different tables in the table hierarchy by clicking their node in the table tree. Double-click a node to get its table inspector (or double click on the table template in the open document).

You can get back to the table group inspector by clicking on the "Table Group" button at the bottom left corner of the table template, or by selecting the table group icon in the "Selection Path" area of the inspector.

Parent Reference

To reference the parent row object from a child table, you can simply use the key prefix "Parent". So if a row in a movie role child table wanted to display the movie title, it could use the key "@Parent. getTitle@".

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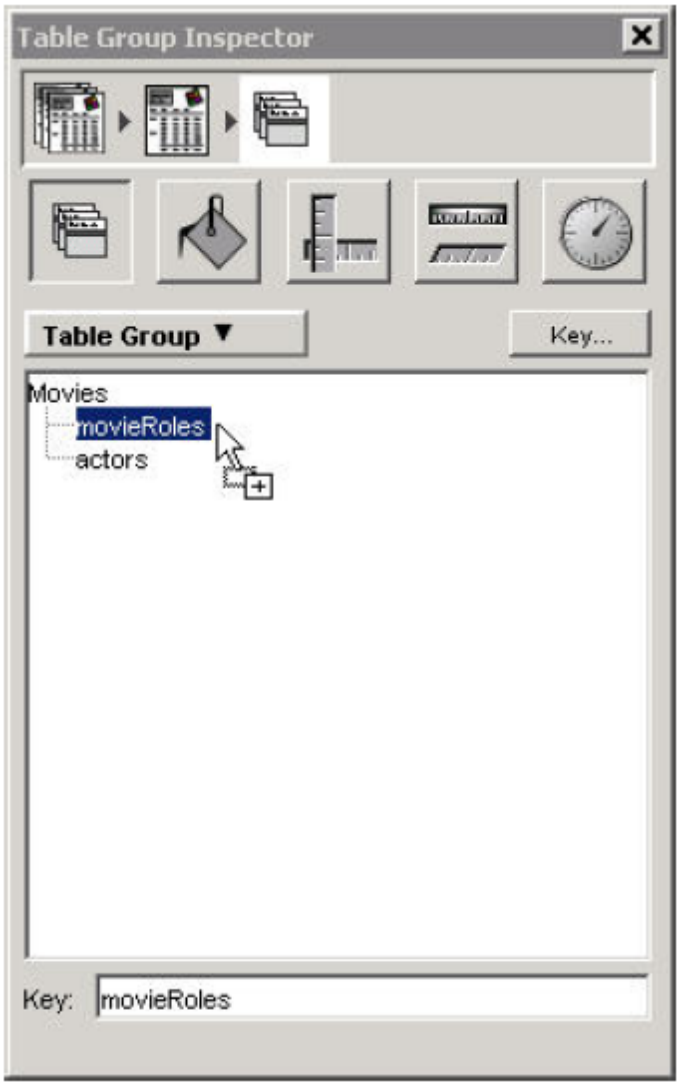

5.8.4 Concepts

5.8.4.1 User Interface

5.8.4.1.1 Selection and Alignment

Selection is done with the selection tool on the tool bar.

Reporting has a "deeper" selection model than the Ignition designer. Simple object selection is done by single clicking an object. "Selecting deep" is done by double-clicking to get into the report hierarchy. For instance, if you group two rectangles together, you can select the individual rectangles by double clicking "into" the group.

Superselection

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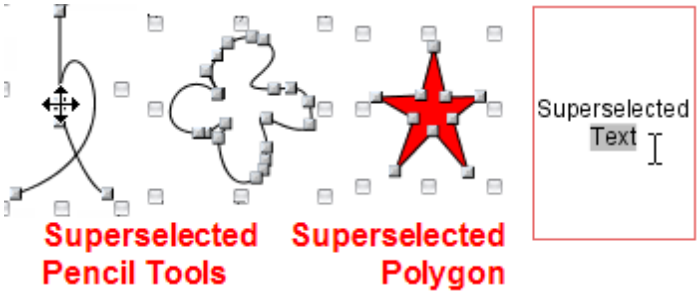
Superselection refers to an editing state that some shapes go into when double clicked. Text is the most common of these. When a text box is selected you can move and resize it. When it's super-selected, you can place the text cursor or select a range of characters and insert or delete text. The polygon and pencil are two other basic tools that support superselection.

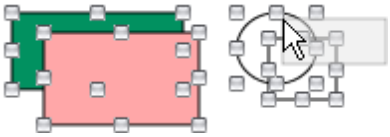


Multiple Selection

Multiple Selection can be done two ways:

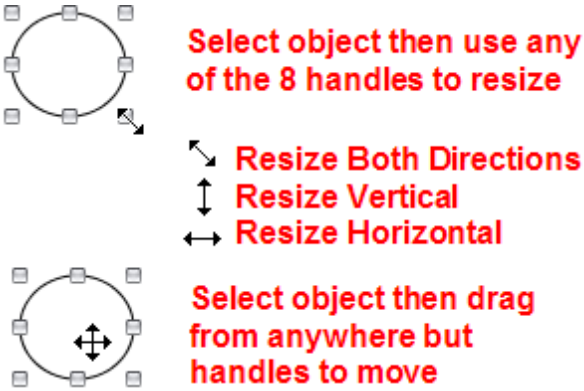
Clicking and dragging the mouse over a range of the report. Everything the selection rectangle touches becomes selected.

Hold the shift key while making a selection or dragging a selection rect. Shapes hit by that action will be added or removed from the currently selected shapes.



Resizing and Moving objects

To resize or move an object first select it with a single click. To *resize* left click and drag one of the 8 resizing handles. To *move* the object, left click and drag anywhere on the object when it is selected. Both operations support shift dragging.



Alignment

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Alignment is accomplished by selecting multiple objects, then choosing "**Make ...**" from the shapes menu or right click menu.

Shapes Menu Item	Function
Make Row Top/Center/ Bottom	Quickly align several shapes in a row, either by their top, center, or bottom border. Useful when shapes are of different heights.
Make Column Left/Center/ Right	Same as above, but for columns, aligning their sides or center.
Make Same Size, Width, Height	Make several shapes the same width, height or both.
Equally Space Row/Column	Equalizes the distance between shapes horizontally or vertically.

Shift Drag

Holding the shift key while you drag shapes will constrain movement to: horizontal, vertical, or 45 degrees.

TIP	Getting used to selection and superselection is one of the most important concepts to master to become proficient with Ignition Reporting.

5.8.4.1.2 Object Layout

Object layout is an important aspect in creating a professional report. Ignition Reporting uses a WYSIWYG (what you see is what you get) approach.

Headers and Footers

Creating headers and footers is just like creating any other set of objects on your report. There is no explicit header or footer section. The key is sizing and positioning your table around your header or footer. Each new page that the table creates will have that same header and footer. The idea extends to pdf based reports.This is illustrated in tutorial #1

Z Order

Z order defines relative order of objects when they overlap. Simply select the object and click "**Bring to front**" or "**Send to back**" in the shapes menu or right click menu.

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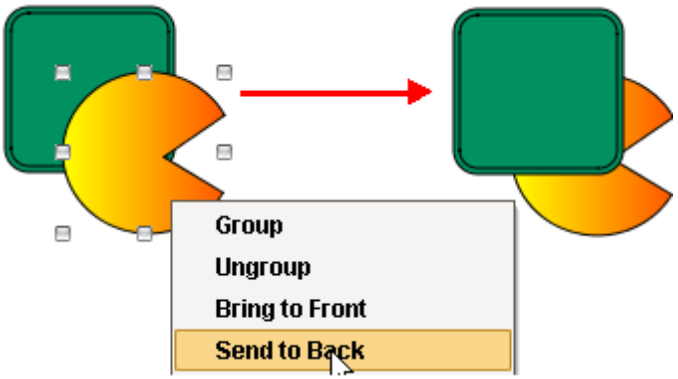
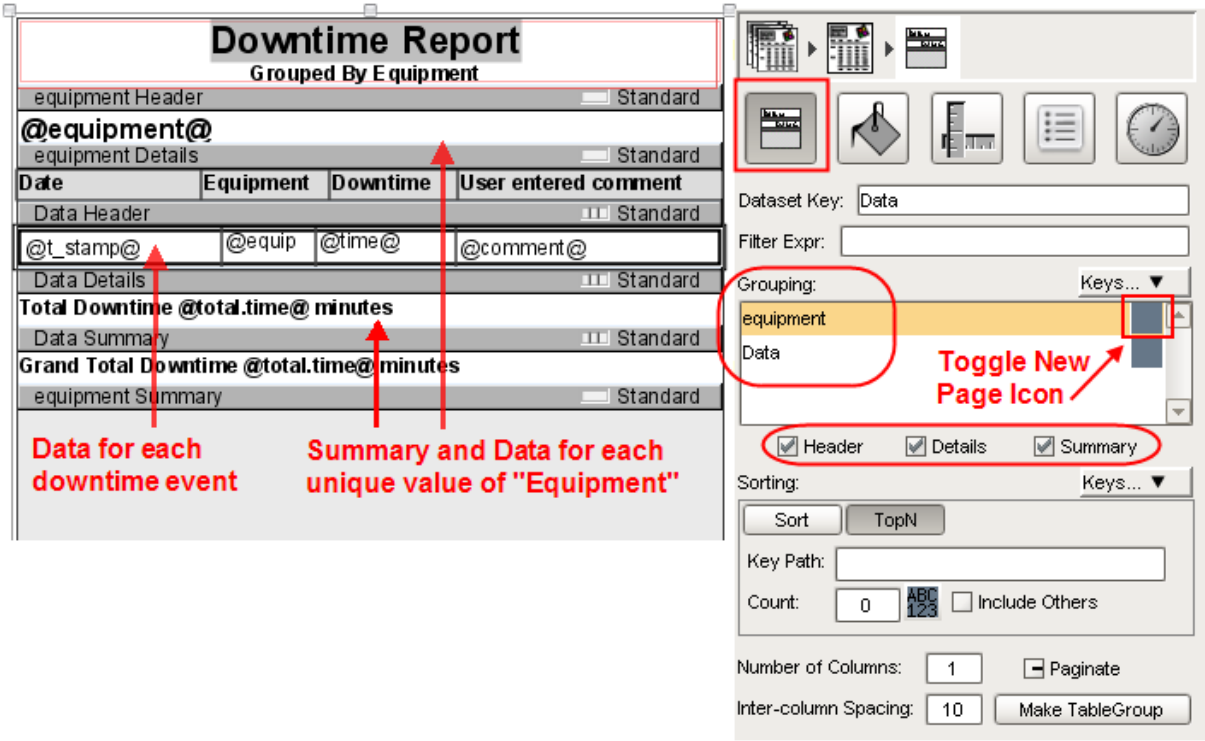


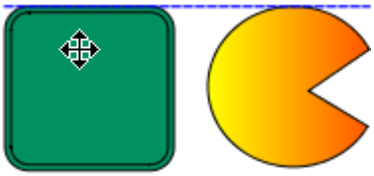
Object Grouping

Grouping makes a set of object behave as one with respect to: selection, moving, and resizing. To "drill down" to individual objects, superselect the grouped object.



Alignment

Alignment is simple. As you move an object around, the Report Designer will draw in a blue dashed line and snap to position when similar edges align. Below the top edge aligns.



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Layers

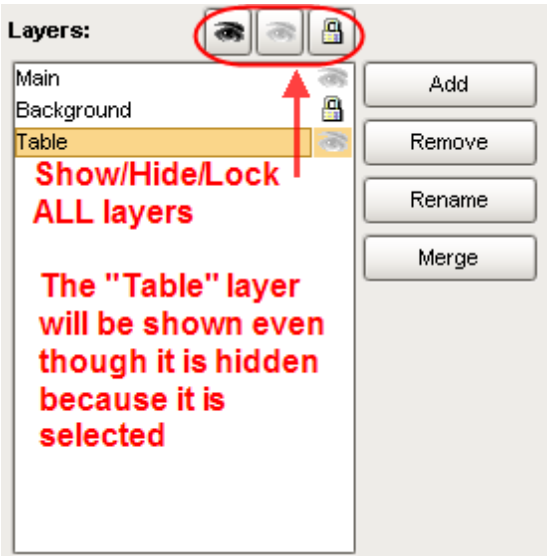
Layers are logical "layers" that take up the space of the entire screen, but contain a subset of the objects on it. They allow you to work on certain parts of your report independently of the rest.

Selecting a layer, even a hidden one, will show it

Show displays a layer and allows you to work on it

Hide hides a layer and doesn't allow you to work on it

Lock displays a layer, but doesn't let you select any objects on it



TIP	Another important aspect of layout is selection and alignment.

5.8.4.1.3 Text Editing

Text editing is pretty straightforward. A few things to know:

Superselection is key here. Distinguish between selecting a text label versus superselecting the text itself.

Text properties that are modified on the font attribute panel (color, **bold** (Cntl+B), *italics* (Cntl+I), font, size) apply to selected (highlighted) text. If you have an entire object selected prior to making a text property change, all text in that object will be modified.

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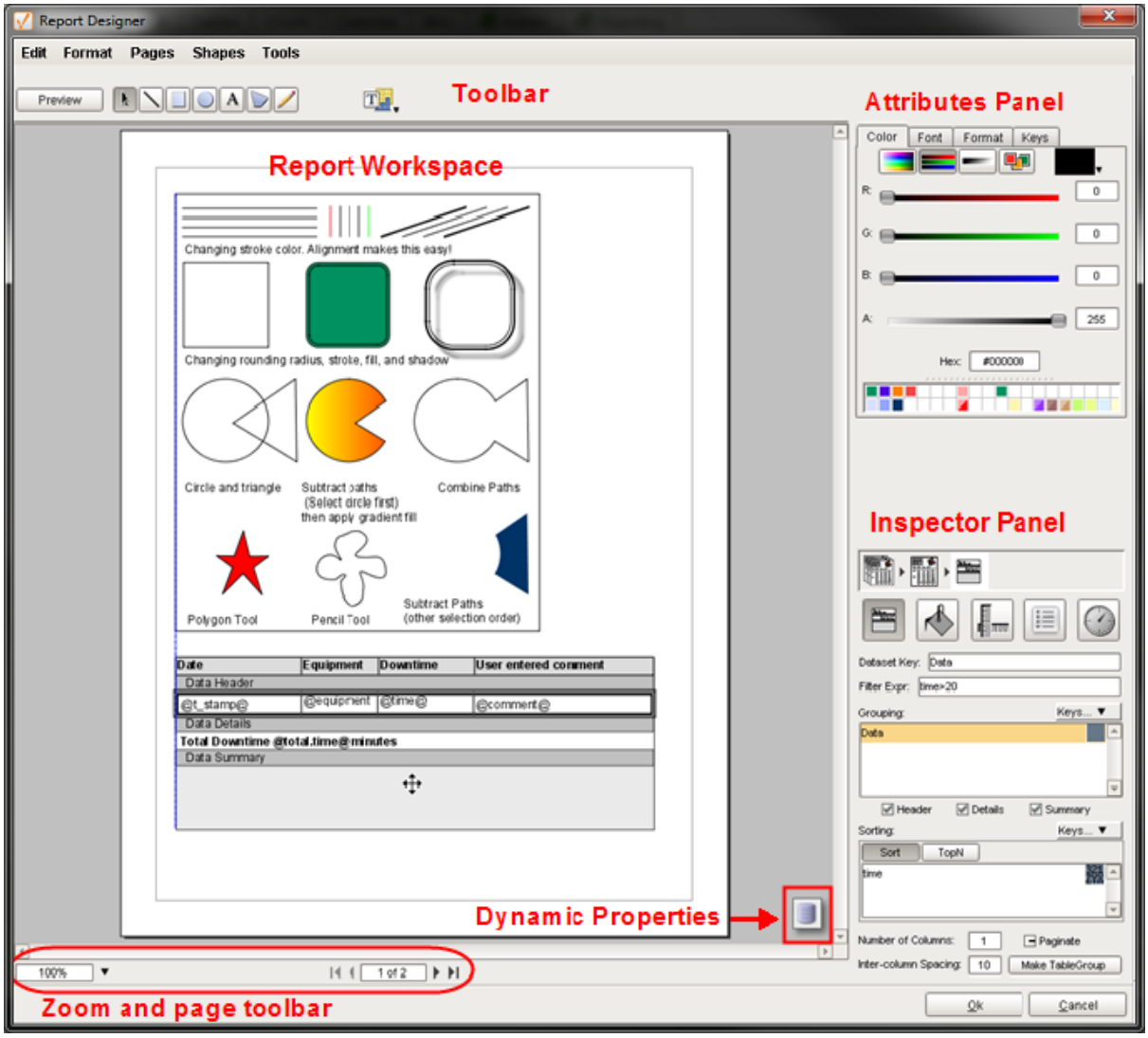
Properties that are modified on the text inspector panel such as: text alignment, shadows, fill and stroke, and transparency are object properties. Changes will usually affect all text in that object regardless of specific text selection.

TIP	Most text properties can be set in the Font Attribute Panel or the Text Inspector Panel. The notable exception is font color, which is set by highlighting text and using the Color Attribute Panel.

5.8.4.1.4 Report Designer

The Report Designer is the Customizer (Cntl+U) for the Report Viewer. It is the window where you create your reports.



Major Sections

The menu provides various options, most for selected objects.

The toolbar allows you to create shapes objects.

The Report workspace is where you create your report.

The Attribute Panel is where you modify common properties.

The Inspector Panel gives you access to more specific object properties.

Dynamic Properties bring Ignition data into your report

5.8.4.1.4.1 Menu

The menu provides quick access to many common functions. It is divided into five sections:

Edit

Format

Pages

Shapes

Tools

Edit

The *edit* menu provides functions like cut, copy and paste.

Menu Item	Function
Undo	Undoes the last action.
Redo	Re-does the last undo (assuming nothing was changed after the last undo).
Cut/Copy/ Paste	Allows you to easily duplicate or import document elements using the system clipboard.
Select All	Selects all elements at the current level of selection (or all text, if editing a text field).

Format

The *format* menu is used for text formatting.

Menu Item	Function
Font Panel...	This selects up the Font Panel tab of the Attributes panel.
Bold, Italic, Underline, Outline	Modifies or unmodifies currently select text or text fields. This functionality is also available in the font panel.

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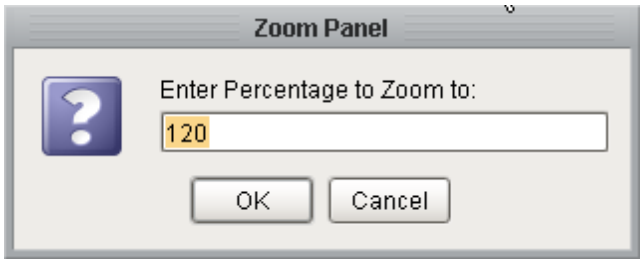
Align Left, Center, Right	Aligns currently selected text or text fields to the left, center or right. This functionality is also available in the Text Inspector.
Subscript, Superscript	Modifies or unmodifies currently select text or text fields.

Pages

The *pages* menu allows you to add or remove pages to the report and change the zoom level

Menu Item	Function
Add Page	Adds a page to the current open document, after the currently selected page.
Add Page Previous	Adds a page to the current open document, before the currently selected page.
Remove Page	Removes the currently selected page in the current open document.
Zoom In/Out	Increases/decreases document zoom by 10%.
Zoom 100%/200%	Zooms to the specified percent of actual document size.
Zoom Toggle Last	Zooms to the last specified Zoom.
Zoom...	Brings up a zoom panel that allows you to exactly specify a zoom as a percentage of actual document size.



Zoom Panel Dialog

Shapes

This *shapes* menu allows you to modify the layout of objects in a report

Menu Item	Function
Group/ Ungroup	Allows you to merge the currently selected shapes into a single shape for convenient management. Contained shapes are still accessible, via double-click super-select. Ungroup separates grouped shapes.
Bring to Front/ Send to Back	All shapes have an order on the page that determines what is drawn on top when two shapes overlap. These options allow you to alter that order.

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Make Row Top/Center/ Bottom	Quickly align several shapes in a row, either by their top, center, or bottom border. Useful when shapes are of different heights.
Make Column Left/Center/ Right	Same as above, but for columns, aligning their sides or center.
Make Same Size, Width, Height	Make several shapes the same width, height or both.
Equally Space Row/Column	Equalizes the distance between shapes horizontally or vertically.
Group in Switch/3D Shape	This feature groups selected shapes in a Switch Shape, which has the same features as Table Row Versions. It's a powerful way to conditionally provide a different look for a specific element.
Move to new layer	Creates a new page layer with the currently selected shapes.
Combine/ Subtract Paths	Takes multiple overlapping shapes (such as a rectangle and an oval) and combines them into a single shape using the combined paths. A powerful tool to construct complex shapes.
Convert Into Image	Converts the selected shape into an image. Be sure to group shapes first if you want to convert multiple shapes into a single image.

Tools

The *tools* menu contains layout tools

Menu Item	Function
Color Panel	Selects the color tab in the Attribute Panel.
Font Panel	Selects the font tab in the Attribute Panel.
Formatter Panel	Selects the format tab in the Attribute Panel.
Keys Panel	Selects the keys tab in the Attribute Panel.
Toggle Rulers	Adds rulers to the page borders to assist in precise layout.
Image Placeholder	Adds an empty image placeholder object to the document, which can be positioned, sized and configured with a substitution key.

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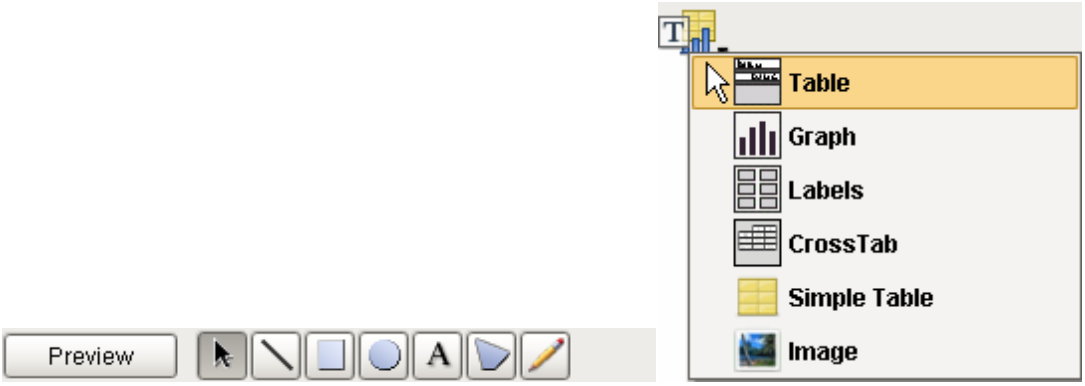
5.8.4.1.4.2 Toolbar

The toolbar allows you to drag shapes and objects into your report



Toolbar Icons

Icon	Name	Description
	Toggle Preview/ Edit Mode	Toggles between Preview and Edit modes. This is equivalent to going between Preview and Design mode in the Ignition designer. **Edit mode** will allow you to make changes to the layout of the report. **Preview mode** will populate the report with data and show you what it will look like in the runtime.
	Selection Tool	Default tool. Clicking on objects with the selection tool will select them for movement or modification.
	Line Tool	Click and drag to create a line.
	Rect Tool	Click and drag to create a rectangle. The Rect inspector will allow you to set rounding radius.
	Oval Tool	Click and drag to create an oval. The oval inspector will allow you to select sweep and start angle.
	Text Tool	Click and drag to create text. Click for more on text editing.
	Polygon Tool	The polygon tool lets you click points that will be joined with straight lines. Alternatively, you can click-drag-release to position line segments interactively. If you hold down the alt key while adding points the polygon tool will behave like pencil for added segments. Editing stops under the following conditions: clicking the same point twice, clicking close to the start point or clicking a new tool in the tool bar (like the selection tool) .
	Pencil Tool	The pencil tool lets you click and draw free-hand path segments, automatically smoothing the curve on mouse up. If you hold down the alt key, it will behave like polygon for added segments. Editing stops under the same conditions as polygon.

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Add Shapes Button

Icon	Name	Description
	Table	Arguably the most powerful Reporting feature. Tables will occupy a fixed size on the screen but create as many pages in the report as the dataset requires. Useful for a downtime report that may cover one day or six months, for example.
	Graph	The graph is a dynamic bar or line graph. It is simple, yet conveys much information.
	Labels	Labels are printable labels that are compatible with standard Avery label sizes.
	Crosstab	Crosstabs summarizes a cross section of data, such as total downtime by both equipment and location.
	Simple Table	The Simple table is a table of a fixed size that doesn't support DataSets. It is easy to work with and ideal if you don't need the flexibility of a table.
	Image	Images make your report look good.
	Image	Image Placeholders provide different images based on conditions.

TIP	Know your basic shape tools and their properties. They can be used to produce professional reports!

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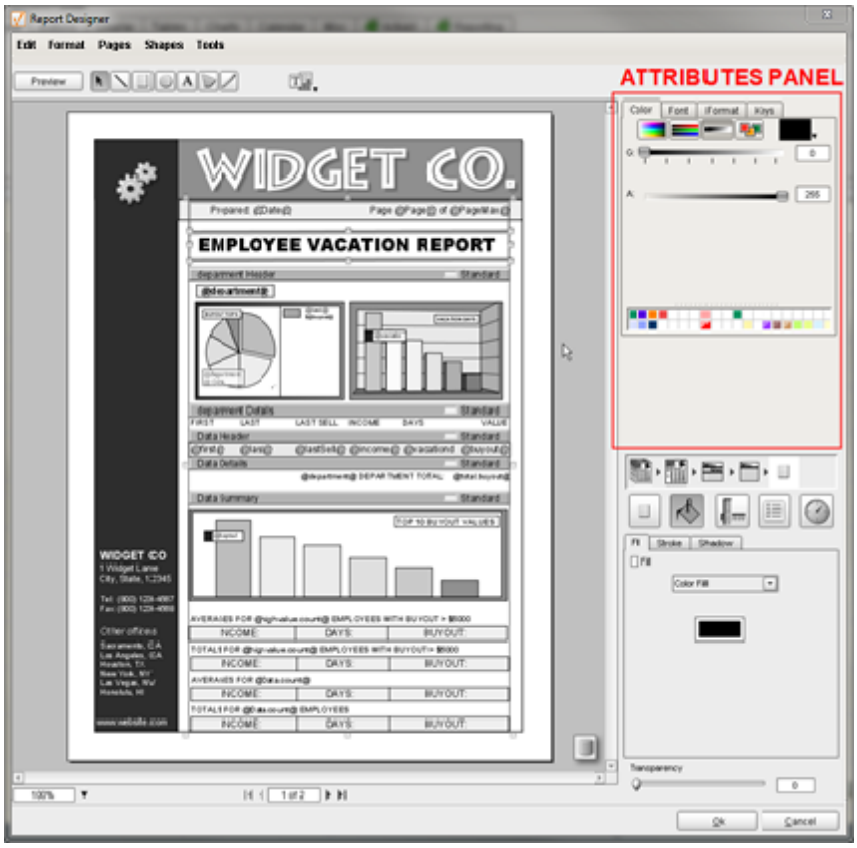
5.8.4.1.4.3 Attributes Panel

The attributes panel is the top right panel on the Report Designer that is used to modify common attributes for simple objects, especially text.

Single click to select your object then make changes in the attributes panel. Often times you will have to double click to drill down to the simple object or property that you want to modify.



Color Tab

The *color tab* is used to change any color in your report. Suppose you wanted to change the fill (background) color of a text label. There are several ways to accomplish this:

1. Left click the label to select it. Click a color on the attribute panel. You'll notice that fill property gets enabled and the background color set to your choice.
2. Select the label. Click on the colored square under the fill tab of the inspector panel to select the color. Choose a color on the attribute panel.
3. Select the label. Drag a color down from the color panel to the colored square under the fill tab of the inspector panel.

All of these changed the fill color. To change the font color of that label you would double click the text label, highlighted the text, then changed the color. The key is getting used to the selection model to change the color of the desired property.

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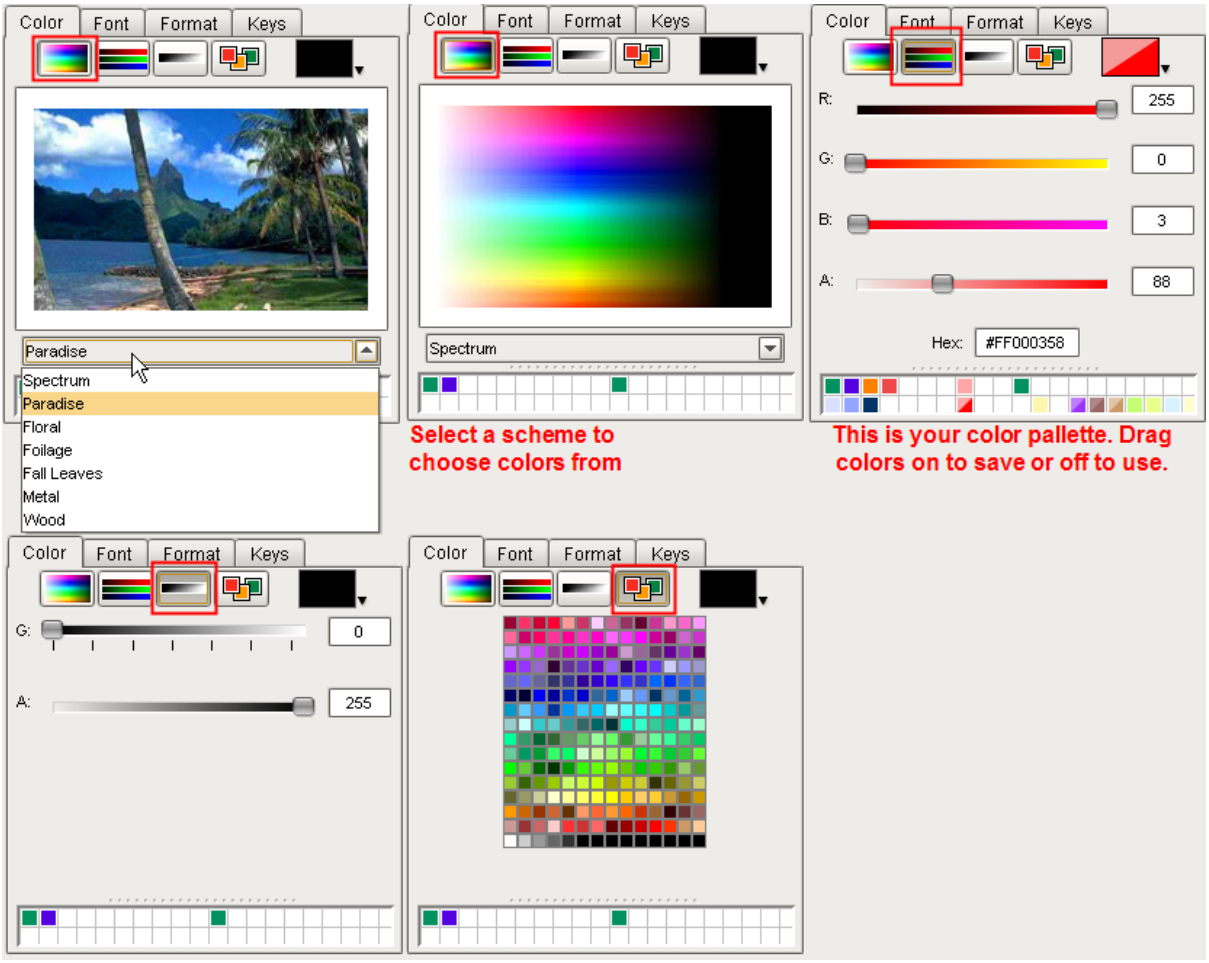

Font Tab

The *font tab* is used to change the family, size, and options of fonts. Selection tends to be much more forgiving since there are relatively few font properties. For example, selecting a label is the same as double clicking that label then highlighting **all of the text**, with respect to the font panel.

To change the color of text, highlight it, then go to the color tab.

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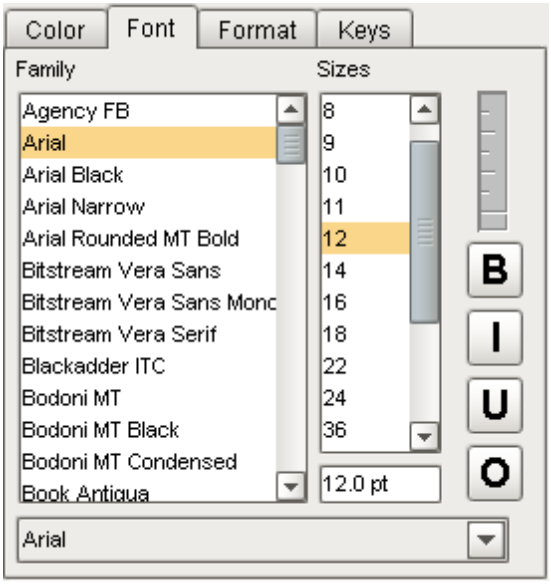
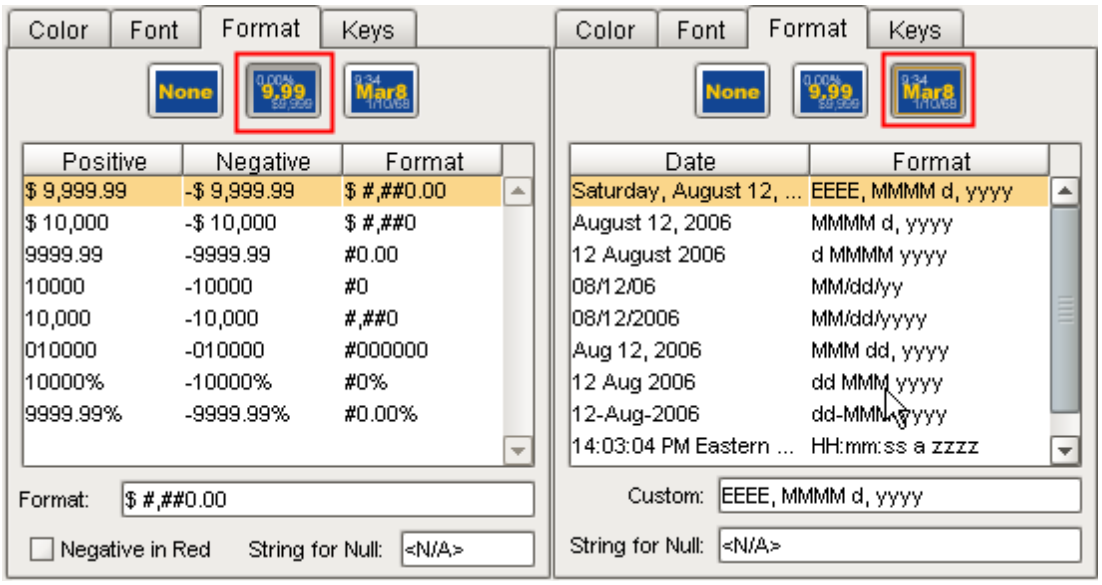


Format Tab

The *format tab* is used to apply formatting to dates and numbers. Highlight desired text and choose formatting. Dates are formatted like the expression **dateFormat** function (shown below). **None** removes formatting.



For the following table, assume the Date is 7/8/2005 3:05:00 PM (July 8th, 2005).

Date Pattern Components		
Character	**Function**	**Example**
M	Month	7
MM	Month, forced 2 digits	07

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MMM	Name of month, abbreviated.	Jul
MMMM	Name of month, full	July
d	Day of the month.	8
dd	Day of the month, forced 2 digits.	08
E	Day of the week, abbreviated.	Sun
EEEE	Day of the week, full.	Sunday
yy	Year - abbreviated.	05
yyyy	Year - Full	2005
H	Hour of the day (0-23)	15
h	Hour of the day (1-12)	3
m	Minute	5
mm	Minute, forced 2 digits.	05
s	Seconds	00
a	AM/PM marker	PM
z	Time zone, abbreviated.	PST
zzzz	Time zone, full	Pacific Standard Time

Keys Tab

The *keys tab* is a convenience that displays your data and builtin functions. Clicking "Built-ins" will toggle between user data and builtin functions. The typical use of the Keys Tab is dragging keys into your report. Here are a few examples of how that could work:

Dragging *last*, a string data key, to your report will create the text label, **@last@**

Dragging *last* to text in a selected text label will add in the text **@last@**.

Dragging a DataSet will open a window prompting to create a table, labels, graph, or crosstab.

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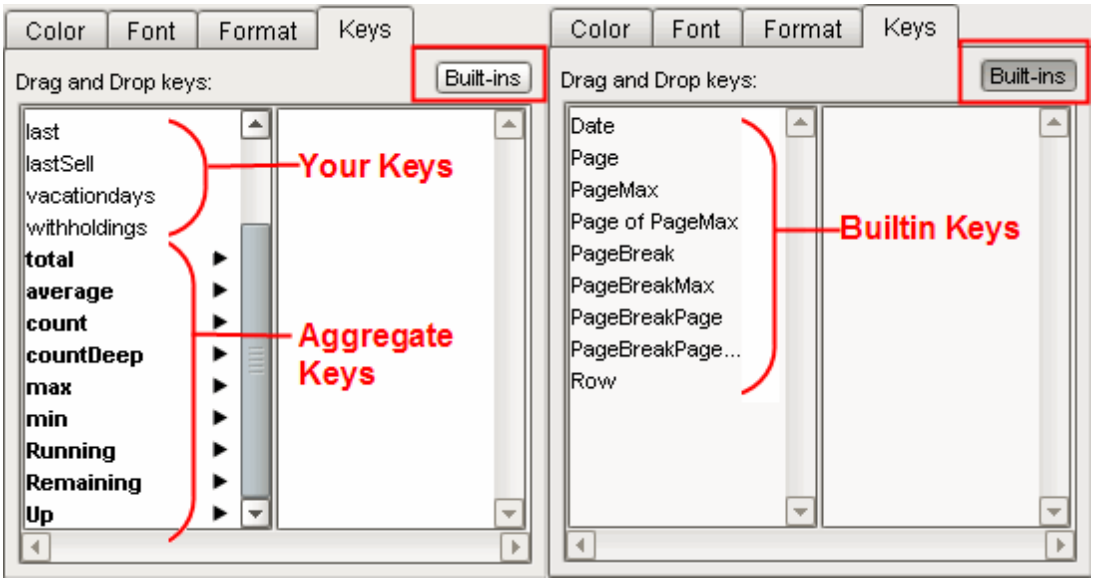

TIP Get to know the attribute panel. Most shared properties reside here. The only other panel to know is the inspector panel, where more complex or object specific settings reside.

5.8.4.1.4.4 Inspector Panel

The inspector panel is the bottom right panel on the Report Designer. It is used to modify object attributes.

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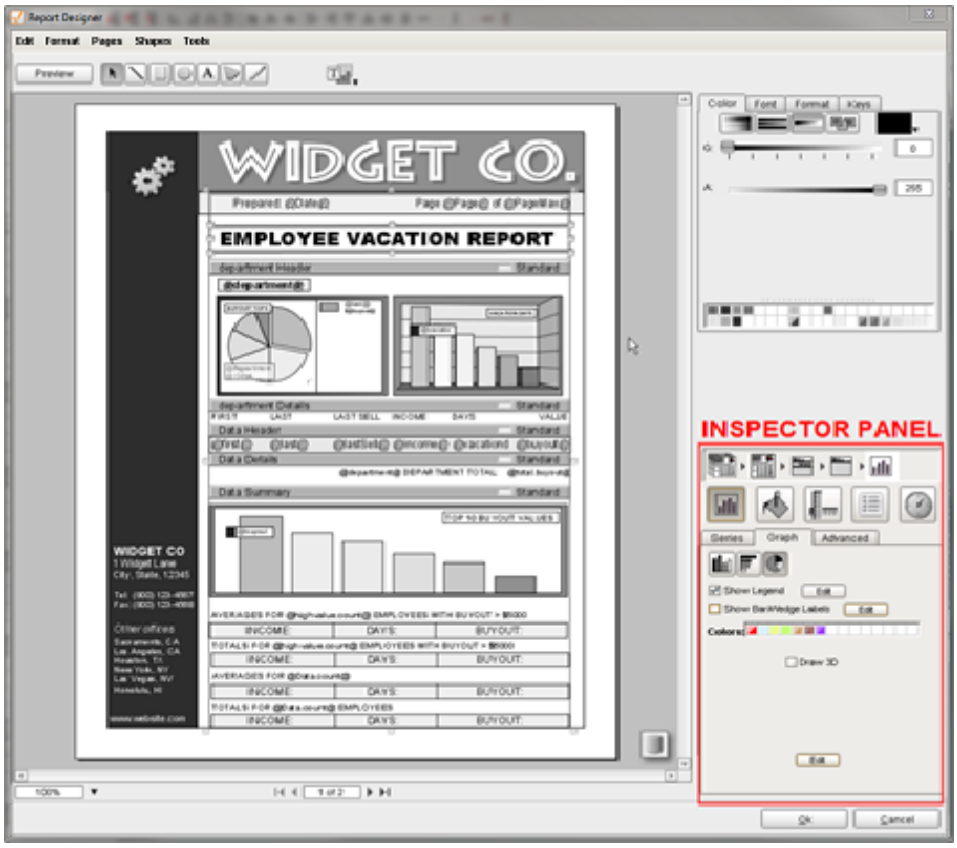

Tutorial #2 example report.

Document Inspector

The Document Inspector is where you set your page layout, paper size, margins, and other top level properties.

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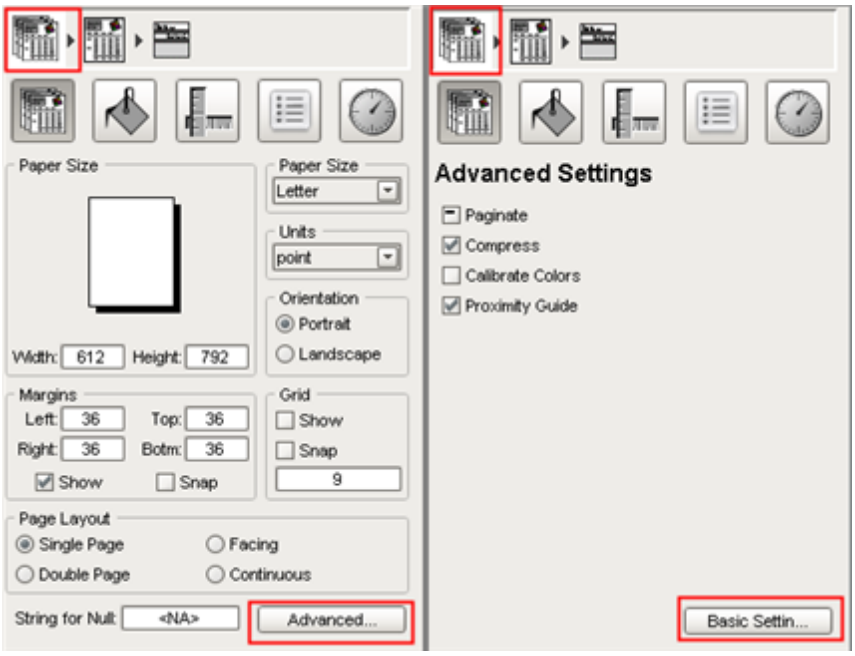

Page Inspector

The Page Inspector deals with document layers. "Layers" are logical grouping containing anything between no objects and every object that takes the space of the whole report. For example, you could create a background layer that contains borders and graphics. You would then create a main layer that is the bulk of the dynamic report. When working on one layer, you could make the other invisible. You can also lock a layer once you're finished with it.

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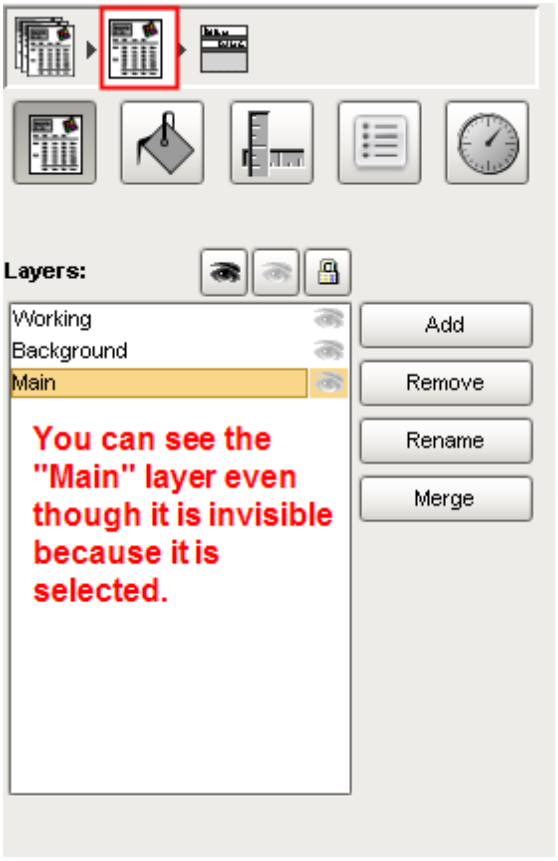

Table Inspector

The Table Inspector defines the dataset, sorting, grouping, and filtering for tables. It is where you choose to display a table's header, detail, and summary.

The Table Inspector can modify data processed by the table, as well as the general look of it.

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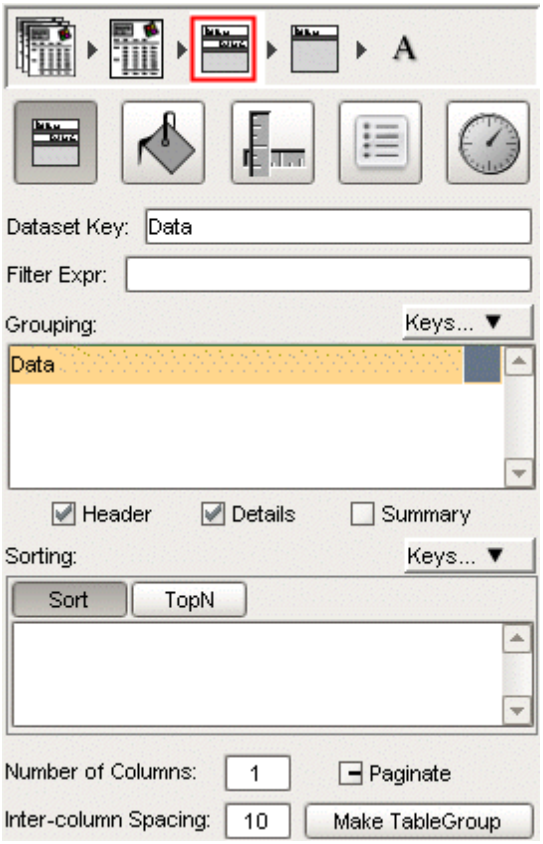

Paginate - Has three setting (Off ☐, On ☑, N/A ⊟) option that determines whether or not a table will use page breaks. Paginating tends to be useful for pdf files, not paginating tends to be good for Flash and CSV files. Typically leave this setting alone.

Table Row Inspector

The Table Row Inspector defines properties of rows in a table. This includes all versions of the header, detail, and summary rows, as well as specifying the version key expression and printing options. It is most easily accessed by superselecting the table, then selecting a table row.

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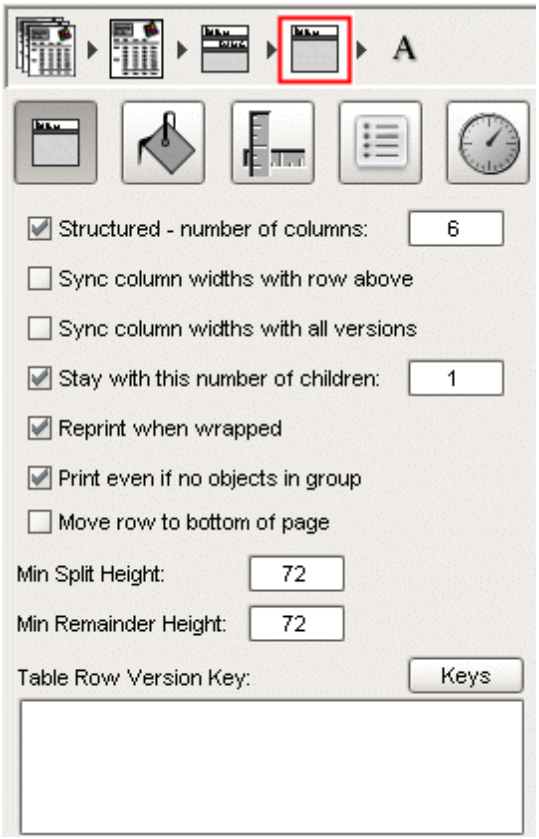

Row Property	Function
Structured Switch/ Column Count	Sets row to unstructured or defines number of columns. This can also be done with table icons.
Sync with parent/ alternates	With structured tables, it's often convenient to have column resizing be reflected in the row immediately above the current row (the parent) or with a table row's different versions (alternates). Once enabled, individual column resizing will affect the corresponding parent or alternate row width. This is useful for synchronizing detail/header row changes.
Stay with this number of children	This is the heart of widow/orphan control. By default, a row is guaranteed to have at least one child in its group on the same page. This prevents such rows from being printed by themselves, which can be confusing. Increase this number for additional family bonding. If it exceeds the number of objects in a group, the group will never be broken across a page boundary.
Reprint when wrapped	When data overruns the bottom of the page and starts on a new page, upper level grouping details and headers are reprinted to retain context. Occasionally this doesn't makes sense. Select the row and click this switch to suppress this behavior. An alternative is to configure a Reprint version.
Print even if no objects in group	By default headers and summary rows for empty lists are suppressed. If you want an indication of the missing data turn this switch on.

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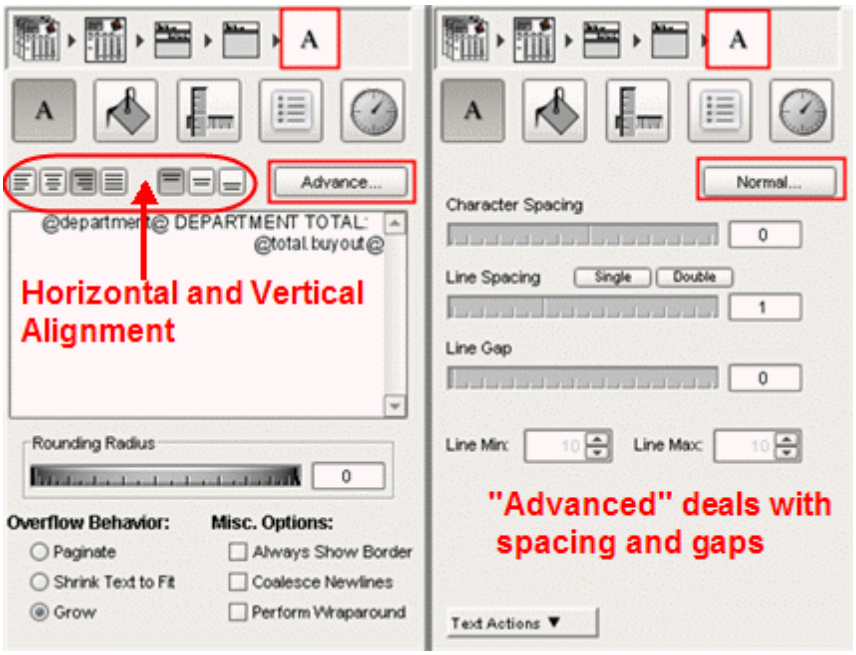
Move row to bottom of page	Normally the Summary row will share a border with the last row on the table. **Move to Bottom** will move it down slightly so that it's always resting on the bottom border of the page. This is commonly used with the Running Summary feature.
Min Split/ Remainder height	An advanced form of widow/orphan control is to be able to control how an exceptionally tall table row will break across a page (usually only the case when a large text block is involved). By default rows will only be split when at least an inch (72pts) was available on the first page (**min split height**) and at least an inch will be carried over to the successive page (**min remainder height**). Most table rows will never use these settings. If you prefer to have table rows use all of the potential page space and don't care about trying to keep related text on the same page, you would set both of these to 10pts. If you never want a row to split, set these to 999.
Table Row Version Key	Allows you to configure different looks for the same table row based on some condition to provide visual hints. The version key expression should return a string that is the name of a version that you've defined. Details here or example here.

Text Inspector

The Text Inspector is where you specify text alignment. More details under text editing. You can use this larger textbox to edit text instead of making text changes directly on objects.



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Option	Function
Rounding	This thumbwheel allows you to set the rounding radius for the text border. It's immediately reflected in the editor window.
Overflow Behavior	Text can be set to **paginate** for form letters, **shrink text to fit** for static text boxes that may receive arbitrarily long text, or **Grow** for text fields in table rows (which can grow to accommodate large text blocks).
Always Show Border	Draws a gray border around text even when not selected. Sometimes useful as a visual cue while editing, without marking generated reports.
Coalesce Newlines	Coalesced newlines will make sure text uses the minimum lines necessary. Useful for substituted data that might contain missing keys, eg, "@name@\n@address1@\n@address2@\n@phone@\n@fax@".
Tab Stops	If you turn on rulers for the editor window (Tools->Toggle Rulers menu), you will notice that it shows tab markers while editing text. These can be dragged and reset to change the tab stops of the text field.

Shape Specific Inspector

The Shape Specific Inspector changes depending on the selected object. It often takes the form of the other inspectors listed on this page. Some objects have custom shape specific inspectors. The left example below is the shape specific inspector for a table, which happens to be the table inspector. The right inspector is the custom shape specific inspector for an image.

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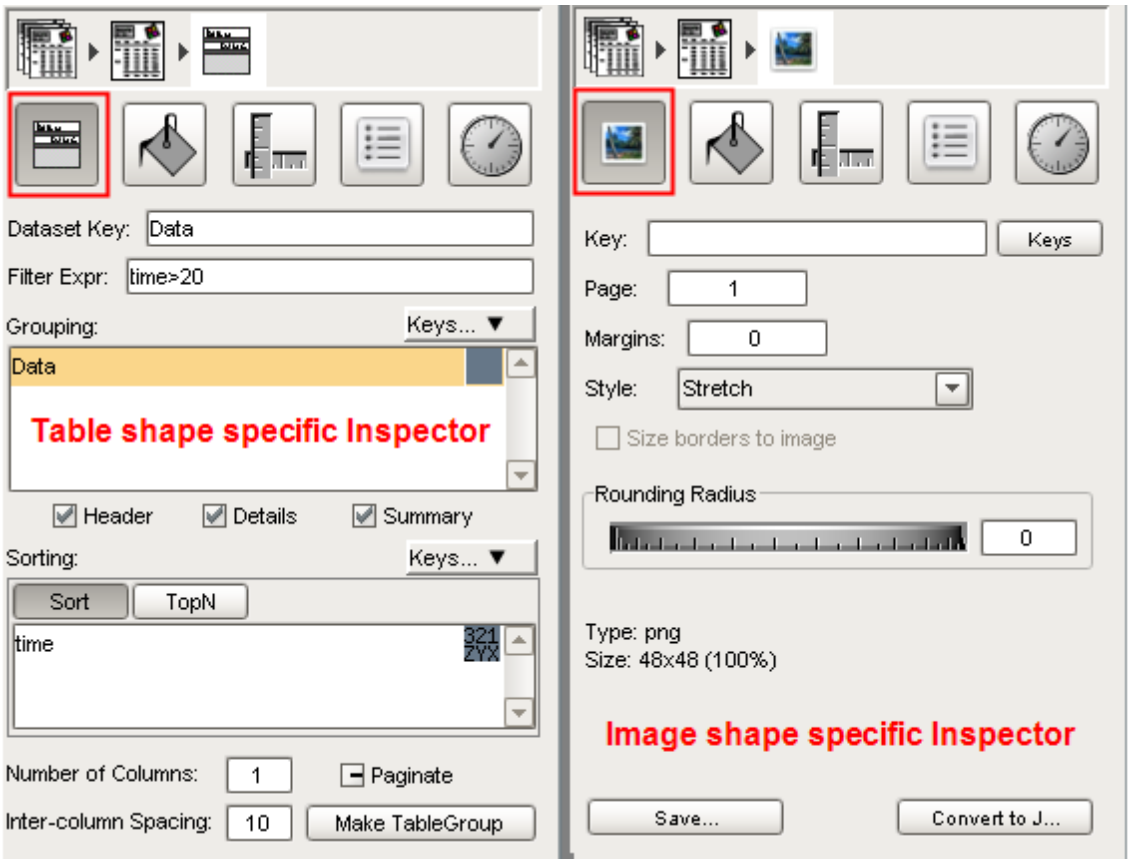

Fill & Stroke Inspector

The Fill & Stroke Inspector is where you set background (fill), outline (stroke), and shadow.

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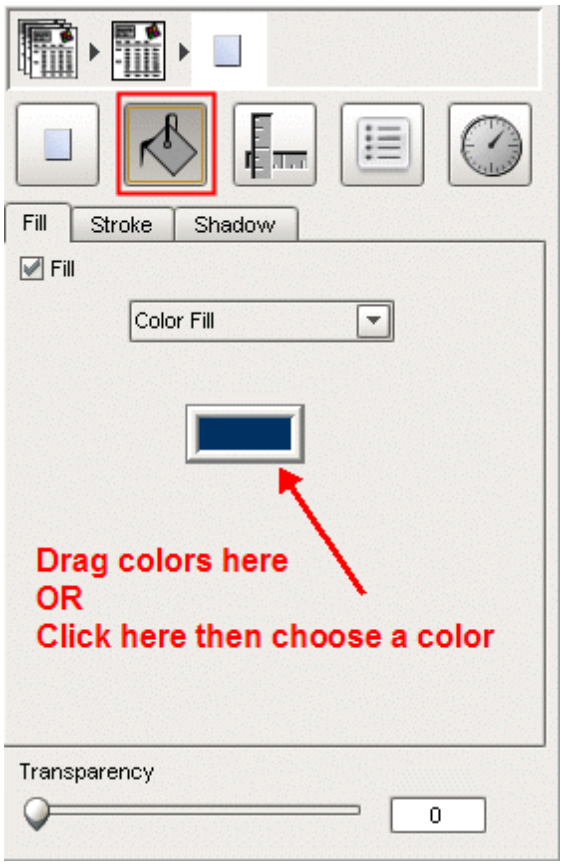

Location & Size Inspector

The Location & Size Inspector allows you to see actual positioning, set auto-sizing, and change properties such as: rotation, scale, and skew. Auto-sizing works by clicking the different regions in the auto-size boxes to draw or erase "springs".

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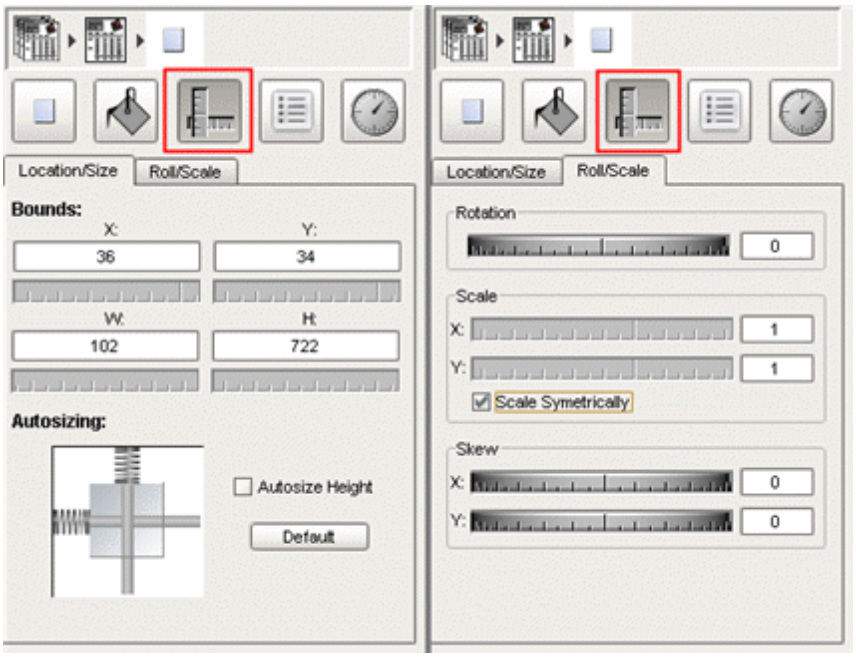

Roll, Scale, & Skew Inspector

The Roll, Scale, & Skew Inspector is a powerful panel that lets you set properties based on expressions (string or number based). You can do things like:

Use **isVisible** property to display an image of a fancy checkbox or exclamation in the row of a table.

Scale the **width** property of a rectangle with a gradient color within a table to indicate progress.

Conditionally change **fontColor** or **fillColor**

Dynamically position an object around with **X** and **Y** properties.

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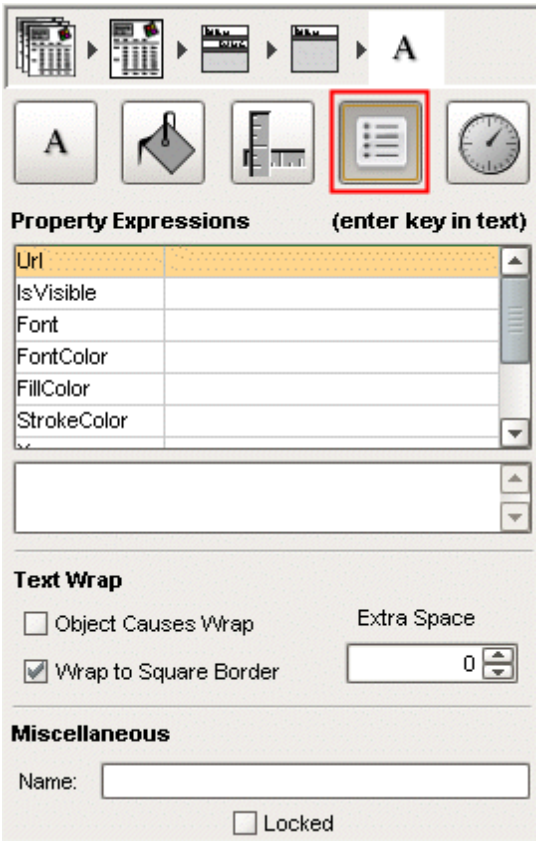

See Property Expressions to illustrate their dynamic use.

Animation Inspector

The Animation Inspector is used to set up animation, which works, but will not be useful unless Reporting enables Macromedia flash based reports. You set up snapshot times and the report will morph the scene from one time to the other.

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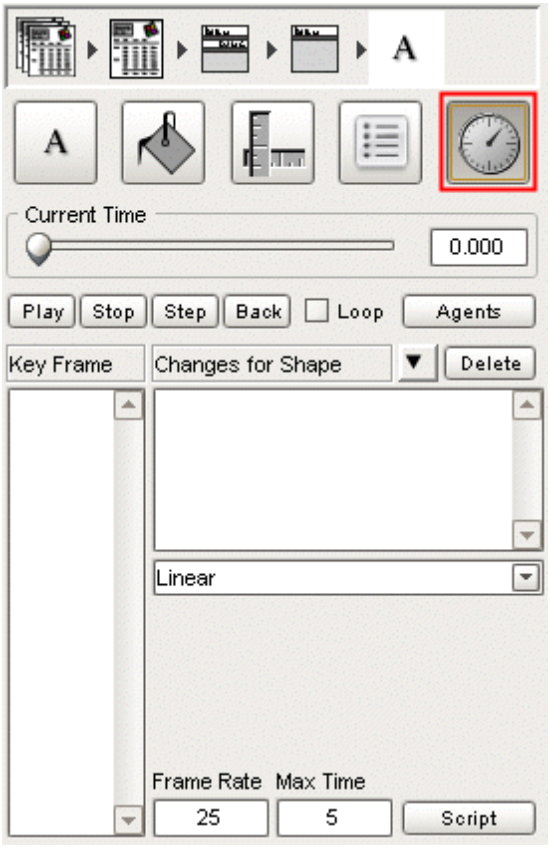

TIP	The inspector panel varies on an object by object basis. If you have trouble changing a property on a complex object, chances are it's here. Try clicking on different parts of the object then going through the Inspector Panel.

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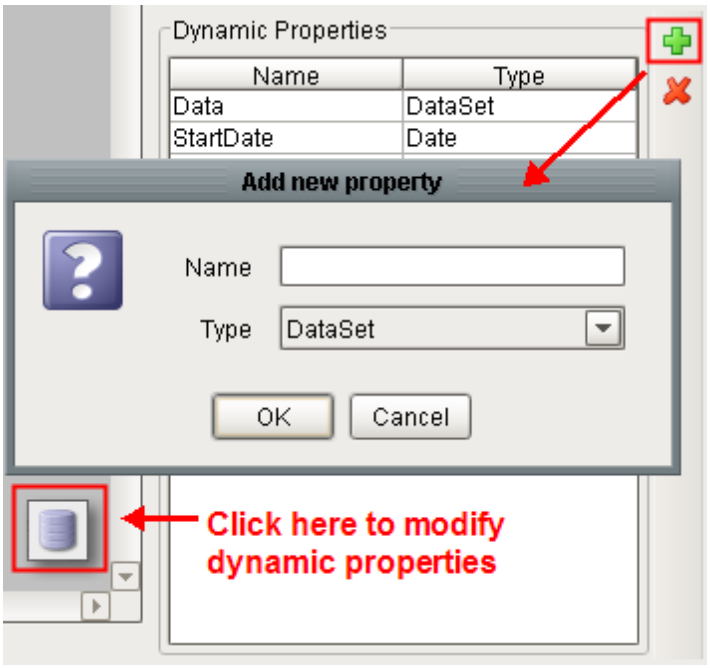
5.8.4.2 Basic

5.8.4.2.1 Dynamic Properties

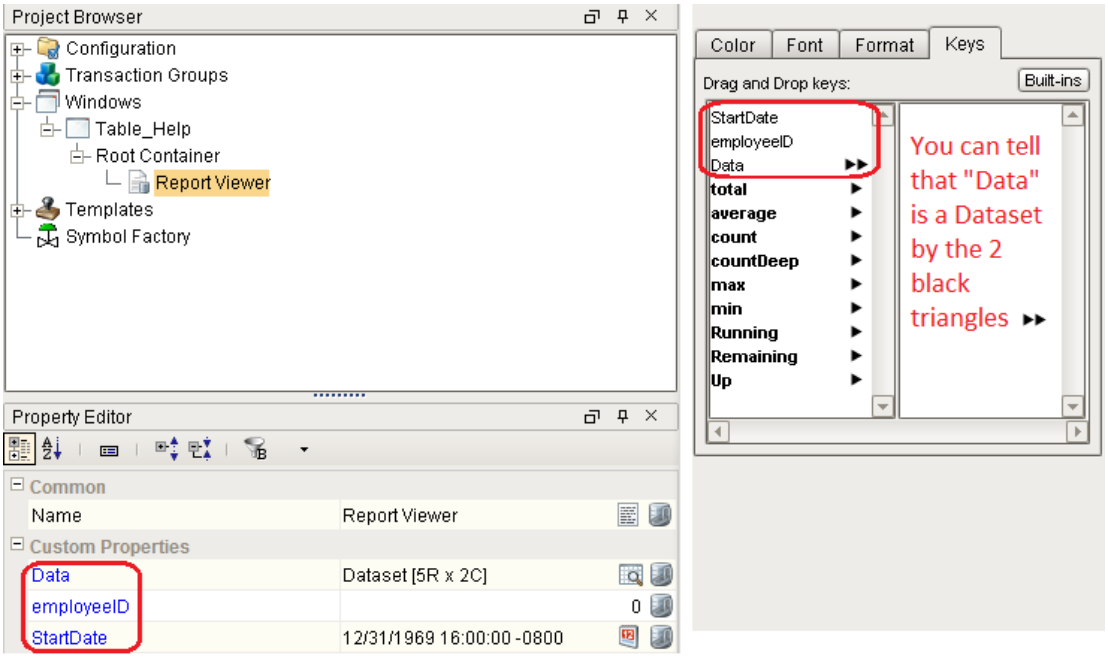
Dynamic Properties are user defined variables and DataSets attached to a report viewer. They allows your report to be populated by data within Ignition. This paradigm is powerful because it gives you the flexibility of Ignition features: use any database connection for SQL queries, expression functions, bindings, etc. This also allows selection changes within Ignition to automatically update your report's data. Reporting dynamic properties work similarly to the dynamic properties of a graph or container.

Report Viewer Dynamic Properties

1. Define dynamic properties in the Report Designer by clicking the database icon in the lower right hand corner of the screen.



2. Click "Ok" to get out of the Report Designer and back into the Ignition designer.
3. Populate your dynamic properties as you would any other Ignition properties.
4. Go back into the Report Designer. Your data is listed under the Keys Attribute Panel



Dynamic Property values are introduced into the report as "keys"

5. Your keys may now be referenced in the Report. For example, **@StartDate@**

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would display **08/25/2006**. It can be formatted however you wish via the Formatter attribute panel.

TIP	Dynamic Properties bring data into your report in the form of keys. To reference these keys, see substitution keys, a fundamental aspect of reporting

5.8.4.2.2 Substitution Keys

The most important part of any reporting system is data substitution. Ignition Reporting uses a familiar mail-merge paradigm, allowing the user to intermingle keys with static text. Keys are delineated by "**@**" symbols, for example: @Date@ or @myVariable@. An example of mixed keys and text, might be "@Page@ of @PageMax@", perhaps resulting in the text "1 of 10".

An interesting thing about keys is that they can be @anything@! You can type any string between two "@" symbols and the Reporting engine will treat it as a key. At run-time it evaluate the key to your dynamic property or a built in key. The syntax for keys follows the rules of Java expressions, described here

If a key cannot be evaluated it will return the **String for Null** property on the document inspector (set to "N/A" by default) .

Your Keys

Your keys are the most important data in the report! Browse through them with the Keys Attribute Panel. Read more about dynamic properties the way to bring data into the report.

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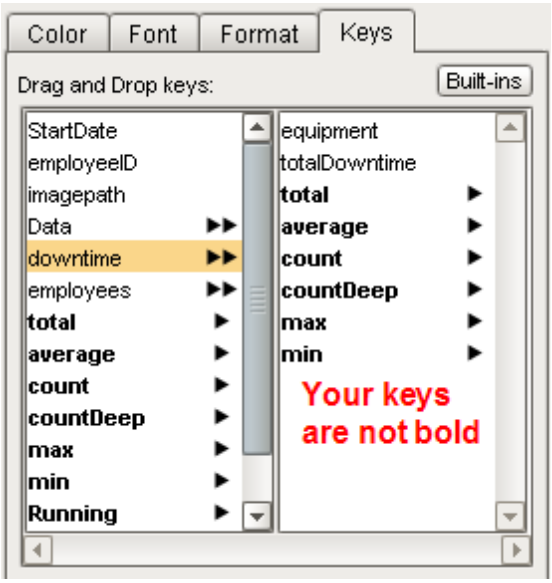

Builtin Keys

The following builtin keys may be typed or dragged from the keys panel

Menu Item	Function
Date	The current date/time. Can be formatted in the formatter panel
Row	The current row number (only in tables).
Page	The current page
PageMax	The total number of pages in the generated report
PageBreak	The number of explicit page breaks encountered
PageBreakMax	The total number of explicit page breaks in generated report
PageBreakPage	The number of pages since last explicit page break
PageBreakPageMax	The total number of pages in current explicit page break

Formatting Keys

Keys that return: dates, currency, or numbers can be formatted by highlighting then using the formatter.

Array Indexing

You can reference an individual object in a list using standard array indexing syntax (brackets) like this: "@Data[0].firstName@".

Aggregates (totals, min/max, average, count)

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The Keys Browser contains a list of built-in keys at the bottom of any given list: **total**, **average**, **min**, **max** and **count**. These allow the user to easily specify aggregate calculations on a set of objects. Suppose we want to see @Data.total.revenue@ or the @data.min.runtime@ or perhaps just @data.count@. When performing an aggregate calculation on the objects in a table the DataSet **Data** is set as the **Dataset Key** so you can use @total.revenue@ instead of @Data.total.revenue@.

The "total2" key

An aggregate calculation will result in null if any of the individual values are null (rather than return a value that is technically incorrect). You can work around this by implementing a derived method that returns a default value if the original attribute is null and aggregating using that key/method. Also, most of the aggregates contain a second version (**"total2"**) that assume that null is equal to zero.

The "count" and "countDeep" keys

The **count** keys tell us how many objects are in a given list or group. This is most commonly used for tables with one or more levels of grouping. If, for instance, you have a table of Movies grouped by their studio and you add the @count@ key to the studio details, it will display the number of movies for each studio. So it might make sense to have a text field with "@studio.name@ has released @count@ movies" (Warner Brothers has released 15 movies).

The **count** key only counts the next level of grouping. If you have multiple levels of grouping and want to count all the root entities use the **countDeep** key. Suppose you have movies grouped by their category and their studio, and want to display a top level summary. You could use: "@studio.name@ has released @countDeep@ movies in @count@ different categories" (Warner Brothers has released 36 movies in 7 categories).

Heritage Keys (Running Totals, percentage totals)

There is an additional set of keys in the Attributes Browser which are used to access upper level groups: **Up**, **Running**, **Remaining**. @Up.count@ would tell us how many objects are in the current level of grouping.

The text field "Row @Row@ of @Up.count@" might show "Row 1 of 5".

By doing some simple arithmetic and using the "Up" key, we can calculate a percentage total: "% Total: @revenue/Up.total.revenue@"

The **running** key references a virtual array containing all of the objects processed thus far in a lower level grouping. This is useful to get a running total. For example, in a ledger:

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"Credit/Debit: @amount@ Current balance: @Running.total.amount@"

The **remaining** key is conceptually the same, but results in a virtual array of remaining objects.For example: "Credit/Debit: @amount@ Remaining Activity: @Remaining.total.amount@"

TIP	Check out substitution keys - expressions, operators, and functions for **even more** substitution keys!

5.8.4.2.3 Expressions, operators, and functions

Key Expressions

You can type in expressions within the "@" symbols to perform calculations on the keys. Here are the operators in order of precedence.

Operator	Function	Example
Parenthesis	(expr) Nested expressions	Any portion of a Key Chain can be enclosed with parenthesis to guarantee precedence.
Multiplicative	*, /, % Multiply, divide, modulo	These are the most common and intuitive operators. You might want to display @quantity*price@ in an invoice line-item or calculate a percent like this @profit/revenue*100@.
Additive	+, - Add, subtract	See **multiplicative** above
Relational	>, <, >=, <= Greater-than, less-than, greater/less-than-equal	These are most useful for conditionals: @amount>=0? "Credit" : "Debit"@ or @name=="this"? "that" : name@.
Equality	==, != Equal, not-equal	See **Relational** above
Logical	AND &&	These operators make it possible to test multiple conditions: @revenue>100 && budget<50? "Winner!"@ or @name=="Jack" || name=="Sam"? "Good Name!"@.
Logical	OR ||	See **and** above
Conditional	? : If/then - with form "expr? true_expr : false_expr"	Provides IF/THEN/ELSE expressions. Note: a false expression is optional. 'null' will be evaluated to false and non-null as true. You can provide null substitutions like this: @name? name : "(None provided)"@. You can also nest conditionals for more conditions. For example, @age>=21?"Adult": (age>12?"Teen":"Child")@.

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Assignments	=, +=	For the brave, you can create temporary variables for use in a report. Most of the functionality you might use this for is covered in more intuitive ways (such as the Running key), but it is possible to define a variable in a header row: @revTotal=0@ and update it in details rows @revTotal+=revenue@.

Math Functions

The following functions return floats.

Menu Item	Function
floor(float)	Round input down to the nearest whole number.
ceil(float)	Round input up to the nearest whole number.
round(float)	Round input to the nearest whole number.
abs(float)	Returns the absolute value of the input (if number < 0 return number * -1).
min(float, float)	Returns the input number with the least value.
max(float, float)	Returns the input number with the greatest value.
pow(float, float)	Returns first number to the second number power.

String Functions

The following functions return strings.

Menu Item	Function
startsWith (String, String)	Returns true if the first string starts with the second.
endsWith (String, String)	Returns true if the first string ends with the second.
substring (String, int start)	Returns a substring of String beginning at position start.
join(List aList, String aKeyChain, String aDelimeter)	Used to display an individual attribute of individual objects as a single String. Suppose you have a list of movies and want to show their titles in a comma separated list: @join(getMovies, "getTitle", ", ")@
substring (Object aString, int start, int end)	obtain a subset of a given string. This could be useful if you wanted to restrict a text field to a certain number of chars: @substring(title, 0, 10)@

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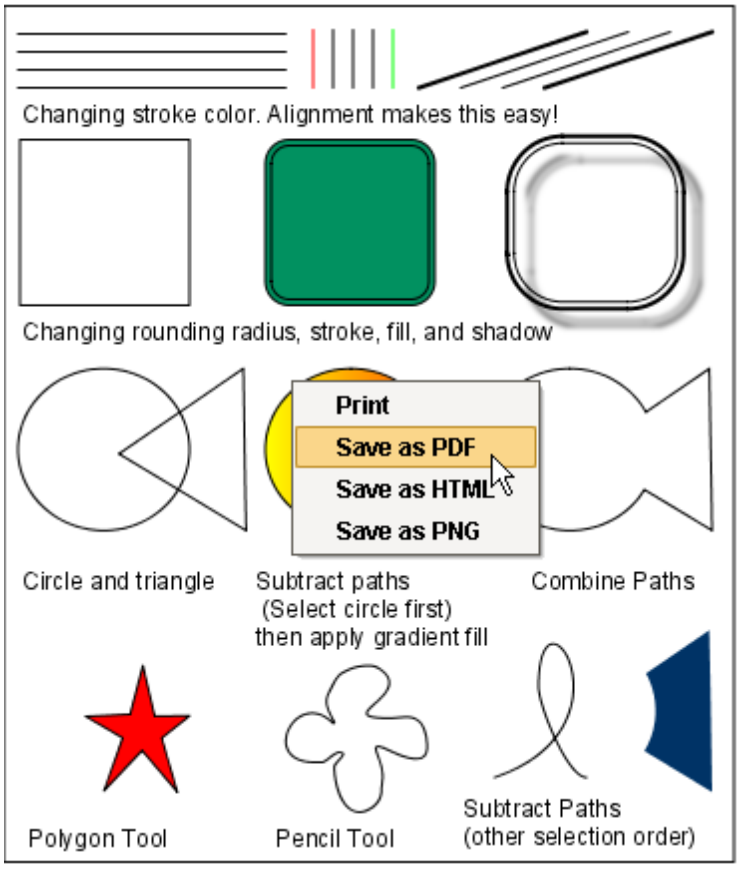
5.8.4.2.4 Saving Reports

Saving a report is simply a matter of right clicking on the report in the Ignition runtime or preview mode of the designer and selecting the format you wish to save it as.



You have the following options:

Print - print your report to a printer

PDF - Adobe Acrobat formatted document

HTML - web page

PNG - image file

5.8.4.2.5 PDF Reports

Create images by clicking on the image button on the add shapes button of the toolbar. Double click on an image in the **Image Browser** window.

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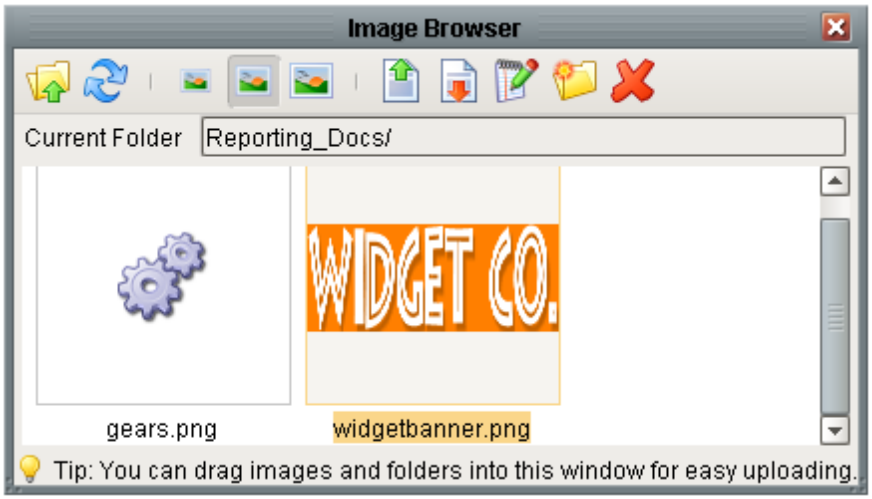

Image Options

Image options are specified in the shape specific inspector for images.

Option	Function
Key	Specify a string expression that returns an image path to change the image. Useful for a multistate image within a table.
Page	Applicable to pdfs only. Selects page number of multipage pdf to display.
Margins	Specifies how many pixels you want of margins around the image.
Style - stretch	Stretches the picture to the image object's size, regardless of aspect ratio.
Style - tile	Tiles the original sized picture within the image object, cutting off sides as necessary.
Style - fit	Resizes picture to image object maintaining aspect ratio.
Style - fit if needed	Resizes picture to image object maintaining aspect ratio, shrinking if necessary, but never enlarging.
Size borders to image	Applicable to **fit** and **fit if needed**.
Rounding Radius	Turns stroke (border) from rectangle, to rounded rectangle, to circle as the number is increased.

Image Placeholders

Images can be populated with BLOB data from an SQL database. They are referred to as *Image Placeholders* when used in this fashon. Simply define the **Key** to the Blob image.

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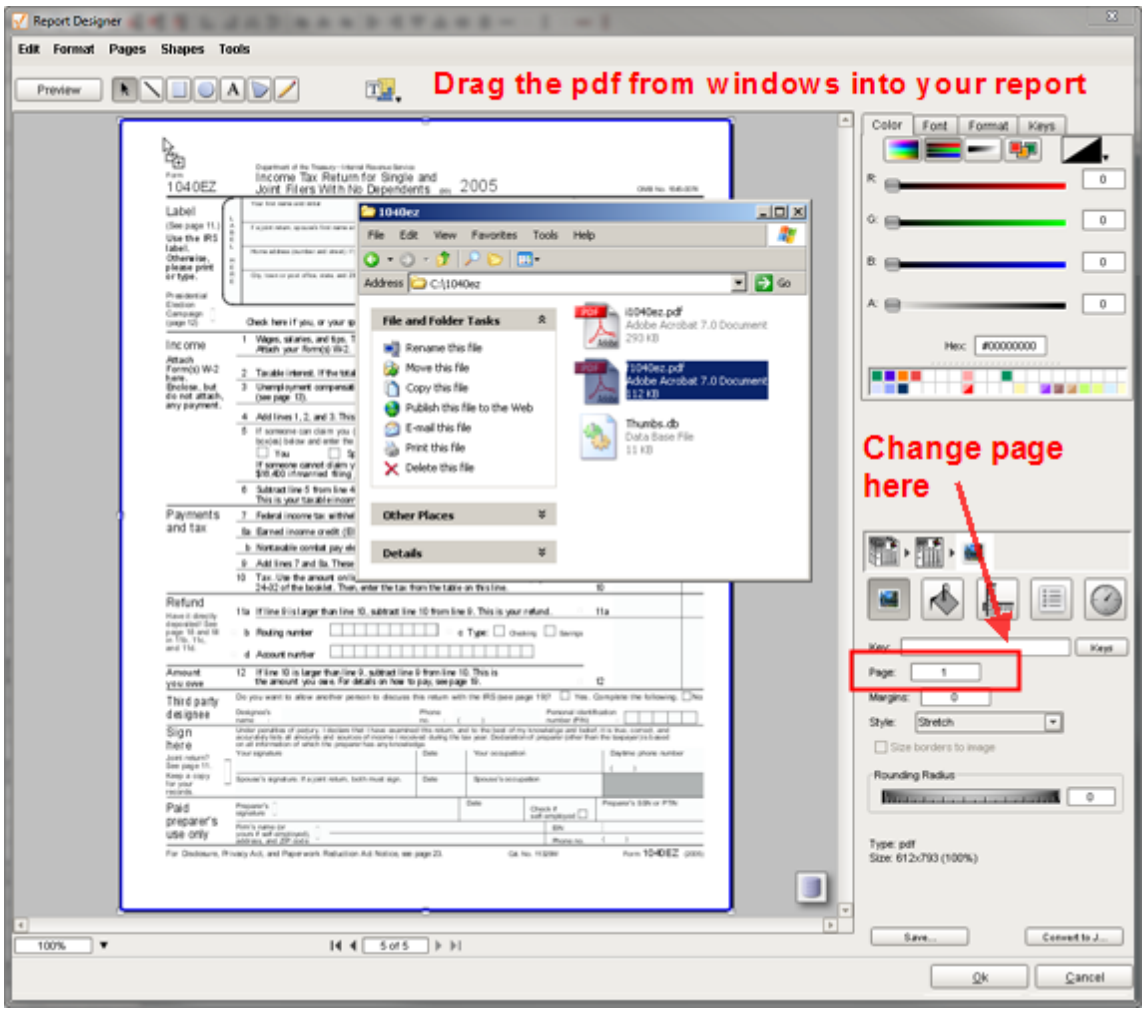
Dept Image	First	Last	Department
	Joe	Blogs	ADMIN
	Julia	Hinderson	ENGINEERING
	Adam	Blackwell	ENGINEERING
	Robert	Hill	SALES
	Brian	Green	ADMIN
	Elaine	Short	SALES
	Tim	Moore	ENGINEERING

Using an *Image Placeholder* and blobs to dynamically illustrate table row based on **department**.

Using Adobe Acrobat (PDF) files

Pdf files are typically used when you have an existing report that you wish to create dynamically. Simply drag text labels or even tables on the pdf to generate a "filled in" report.



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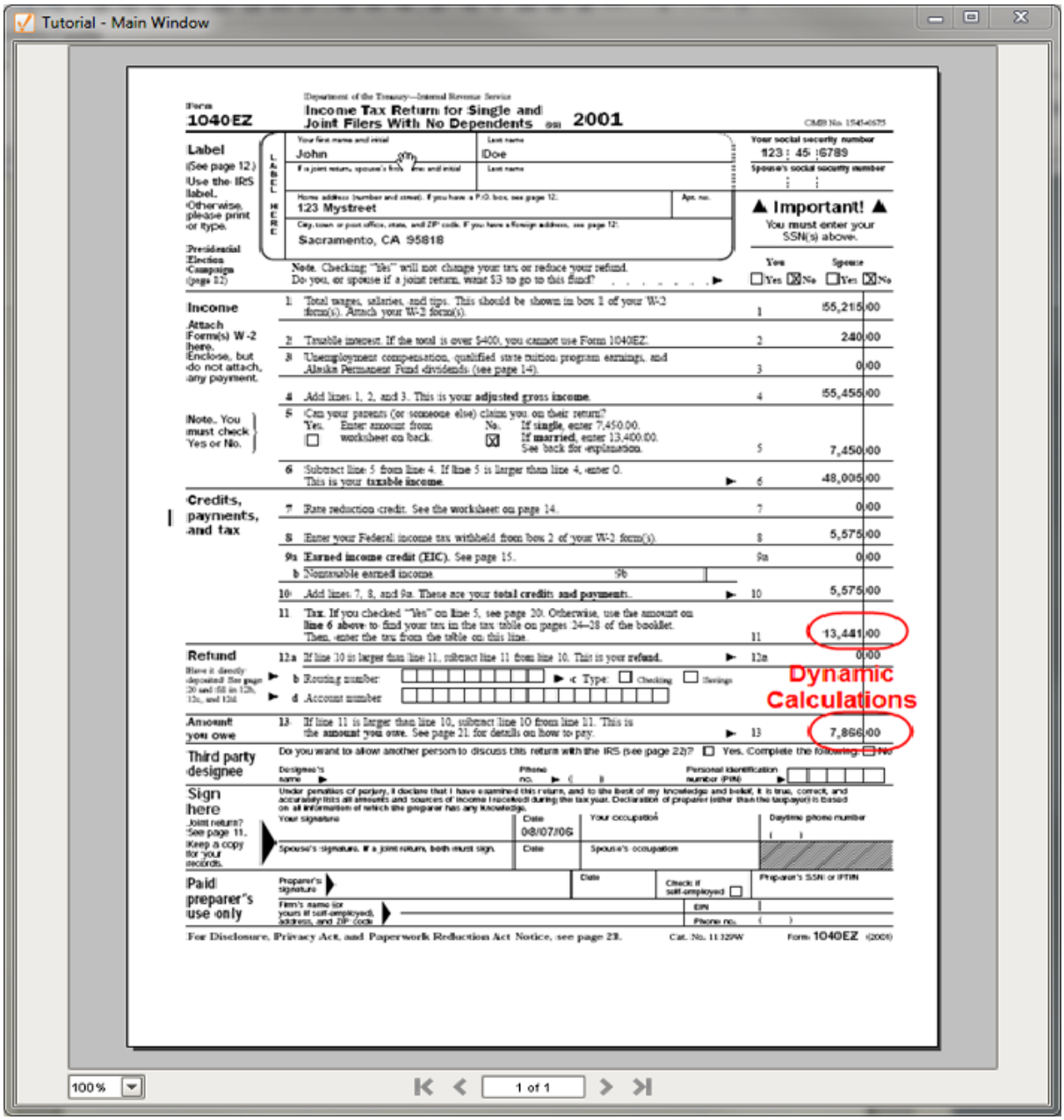
Tutorial - Main Window
Form 1040EZ
Income Tax Return for Single and Joint Filers With No Dependents 2001
Dynamic Calculations
100%
1 of 1
A filled out pdf report

TIP	Extract only the pdf pages that you are going to use before putting them into your report.

5.8.4.2.6 Date Formatting Paterns

The attributes panel is the top right panel on the Report Designer that is used to modify common attributes for simple objects, especially text.

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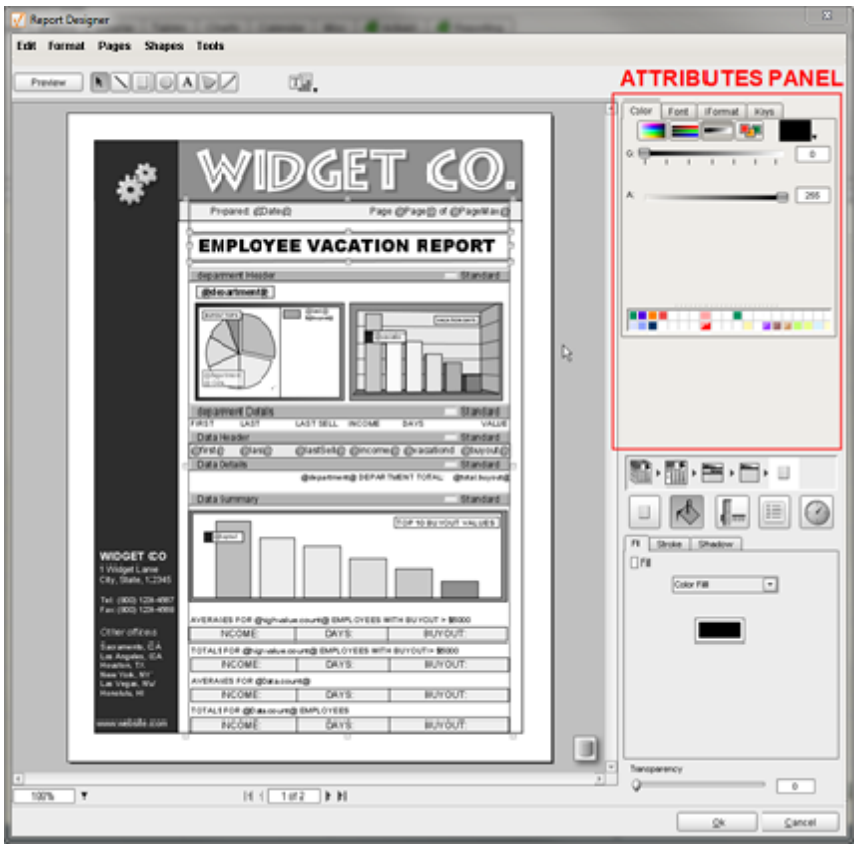
Single click to select your object then make changes in the attributes panel. Often times you will have to double click to drill down to the simple object or property that you want to modify.



Color Tab

The *color tab* is used to change any color in your report. Suppose you wanted to change the fill (background) color of a text label. There are several ways to accomplish this:

1. Left click the label to select it. Click a color on the attribute panel. You'll notice that fill property gets enabled and the background color set to your choice.
2. Select the label. Click on the colored square under the fill tab of the inspector panel to select the color. Choose a color on the attribute panel.
3. Select the label. Drag a color down from the color panel to the colored square under the fill tab of the inspector panel.

All of these changed the fill color. To change the font color of that label you would double click the text label, highlighted the text, then changed the color. The key is getting used to the selection model to change the color of the desired property.

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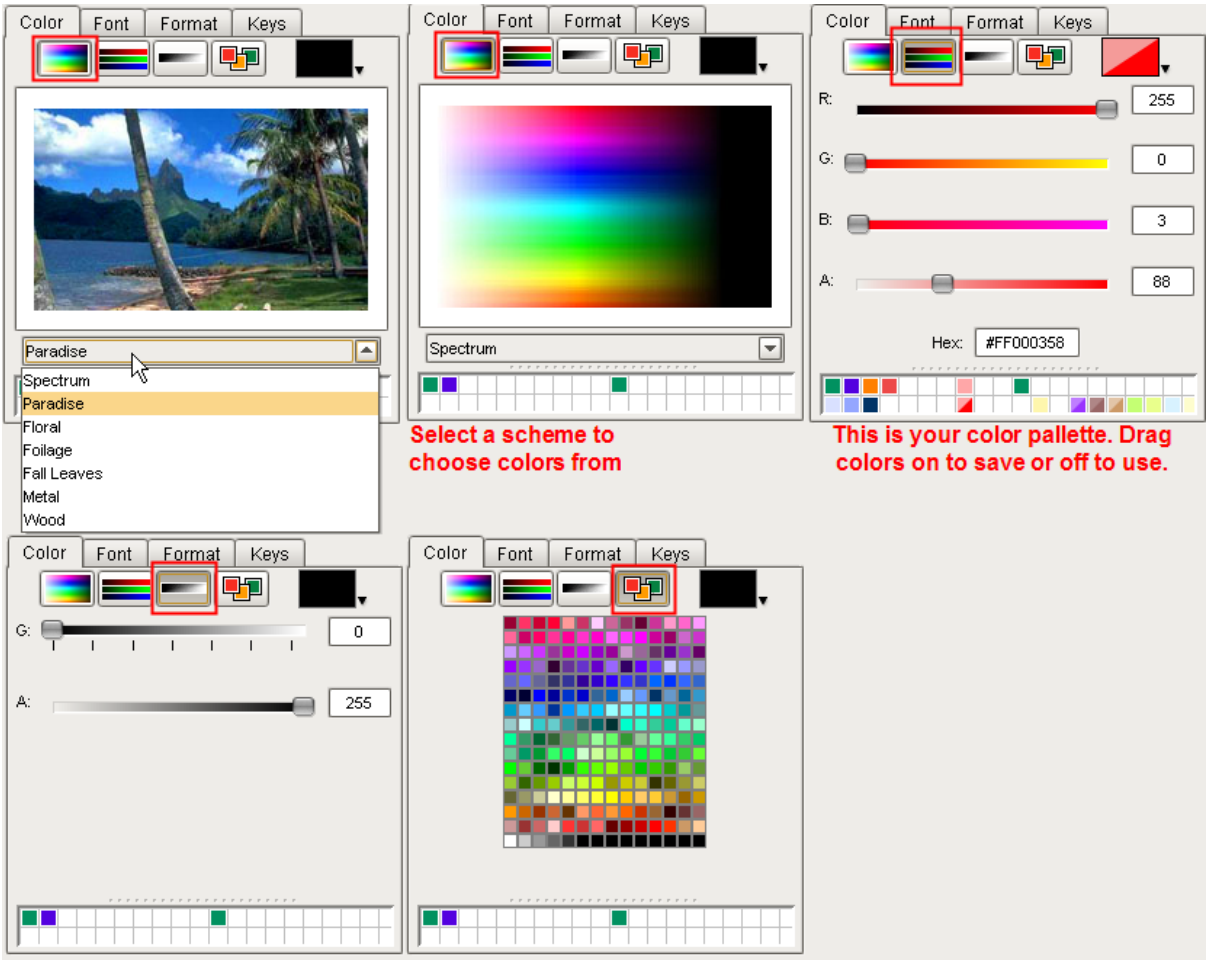

Font Tab

The *font tab* is used to change the family, size, and options of fonts. Selection tends to be much more forgiving since there are relatively few font properties. For example, selecting a label is the same as double clicking that label then highlighting **all of the text**, with respect to the font panel.

To change the color of text, highlight it, then go to the color tab.

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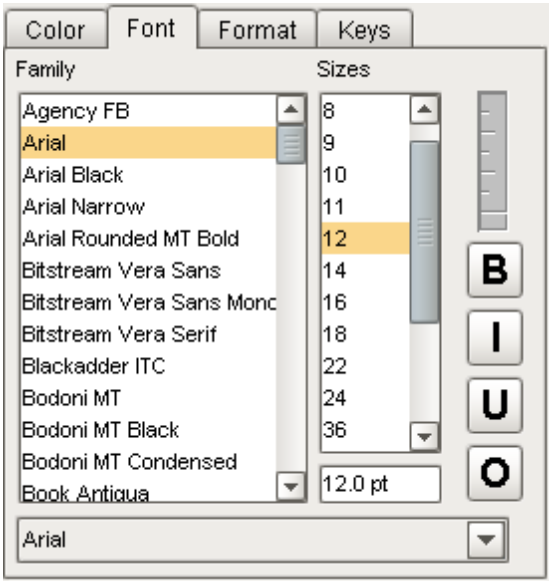
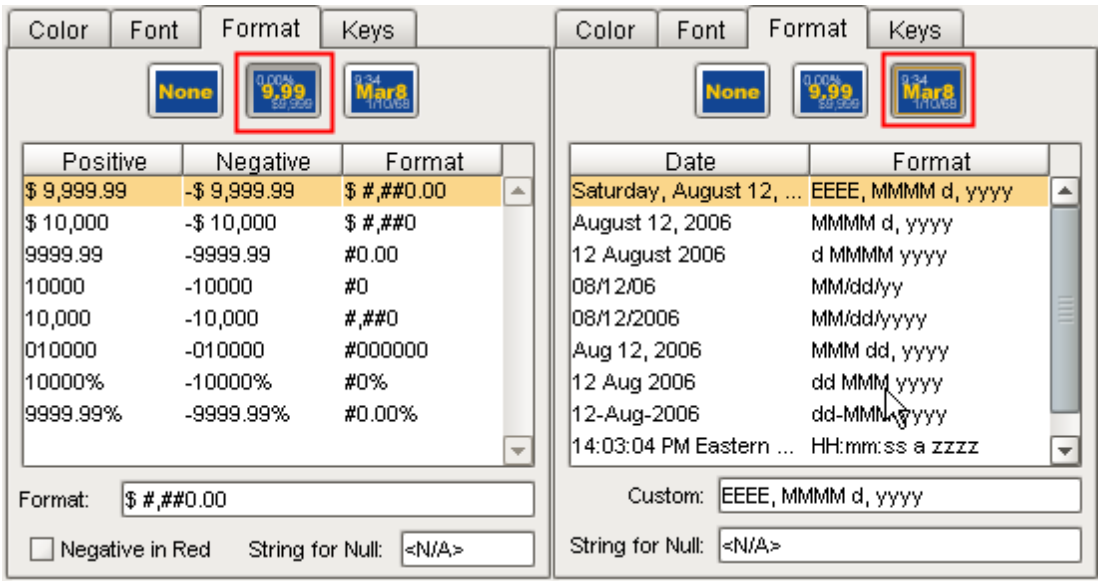


Format Tab

The *format tab* is used to apply formatting to dates and numbers. Highlight desired text and choose formatting. Dates are formatted like the expression **dateFormat** function (shown below). **None** removes formatting.



For the following table, assume the Date is 7/8/2005 3:05:00 PM (July 8th, 2005).

Date Pattern Components		
Character	**Function**	**Example**
M	Month	7
MM	Month, forced 2 digits	07

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MMM	Name of month, abbreviated.	Jul
MMMM	Name of month, full	July
d	Day of the month.	8
dd	Day of the month, forced 2 digits.	08
E	Day of the week, abbreviated.	Sun
EEEE	Day of the week, full.	Sunday
yy	Year - abbreviated.	05
yyyy	Year - Full	2005
H	Hour of the day (0-23)	15
h	Hour of the day (1-12)	3
m	Minute	5
mm	Minute, forced 2 digits.	05
s	Seconds	00
a	AM/PM marker	PM
z	Time zone, abbreviated.	PST
zzzz	Time zone, full	Pacific Standard Time

Keys Tab

The *keys tab* is a convenience that displays your data and builtin functions. Clicking "Built-ins" will toggle between user data and builtin functions. The typical use of the Keys Tab is dragging keys into your report. Here are a few examples of how that could work:

Dragging *last*, a string data key, to your report will create the text label, **@last@**

Dragging *last* to text in a selected text label will add in the text **@last@**.

Dragging a DataSet will open a window prompting to create a table, labels, graph, or crosstab.

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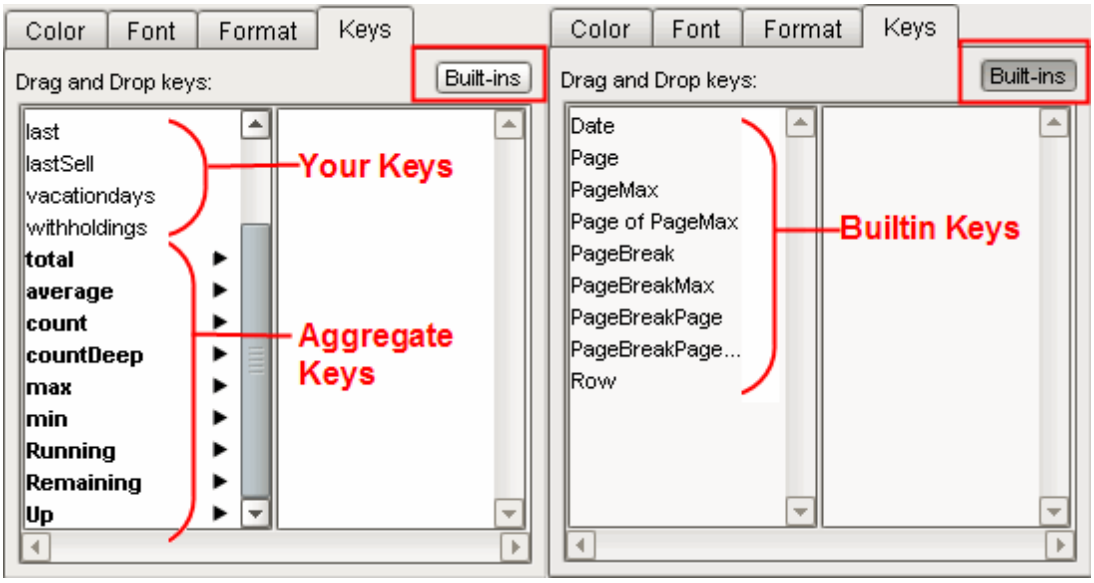

TIP Get to know the attribute panel. Most shared properties reside here. The only other panel to know is the inspector panel, where more complex or object specific settings reside.

5.8.4.2.7 Label Switch Versions, Graph

The *Graph* is a DataSet element like the table. It shows a 2D or 3D graphical representation of data in the form of bar graph or pie graph. Graphs are useful for illustrating relative amounts of summarized data.

Populating data including the concepts of data keys, sorting, and filtering are nearly identical to that of a table. The look of the graph has a much deeper superselection model than a table.

Example

We will explore graph options with a total downtime by equipment example. The same data is used as the table example.

A downtime summary can be retrieved with the following SQL query:

```
SELECT equipment, sum(time) AS totalDowntime FROM downtime GROUP BY
equipment;
```

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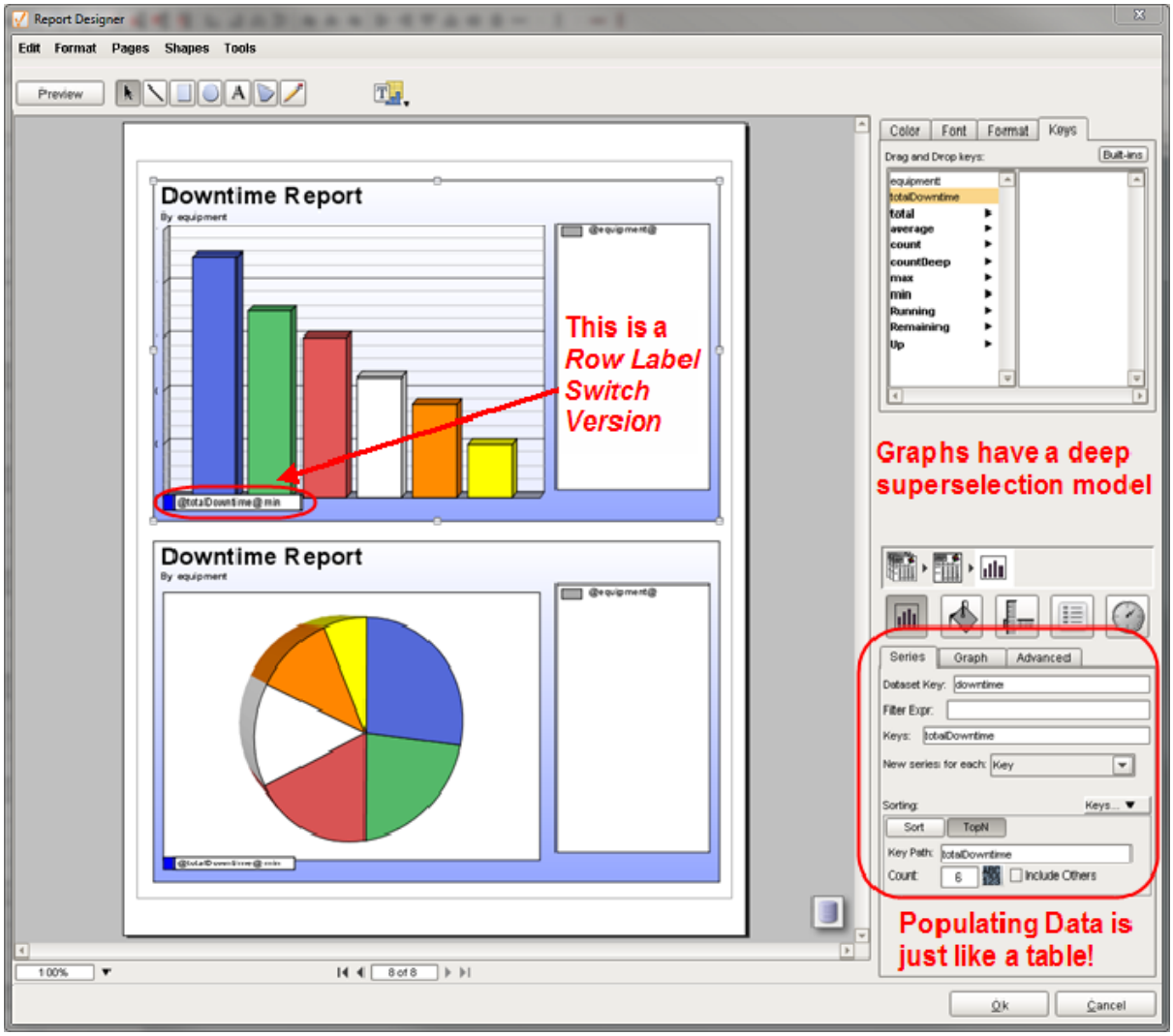
equipment	downtime
conveyor line	78
filler	68
labeler	84
palletizer	27



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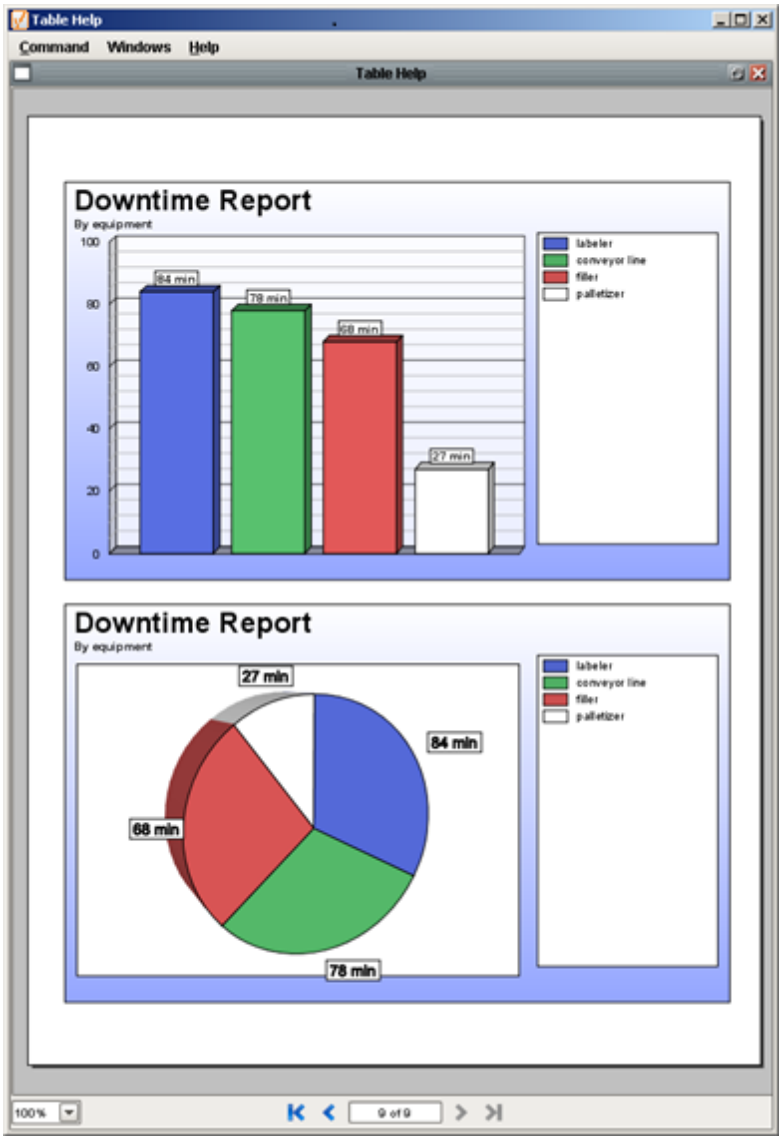

Report in the Ignition runtime

Graph Settings

Basic graph settings can be found on the *Graph* Tab of the graph shape specific inspector .

Graph Menu Item	Function
Graph Type	Choose Bar , Horizontal Bar , or Pie type graph.
Show Legend	Displays a legend object to label series
Show Bar/ Wedge Labels	Builtin graph labels. You may want to rotate them to create space.
Colors:	Drag colors to define graph series colors. Colors will repeat if rightmost color is white.

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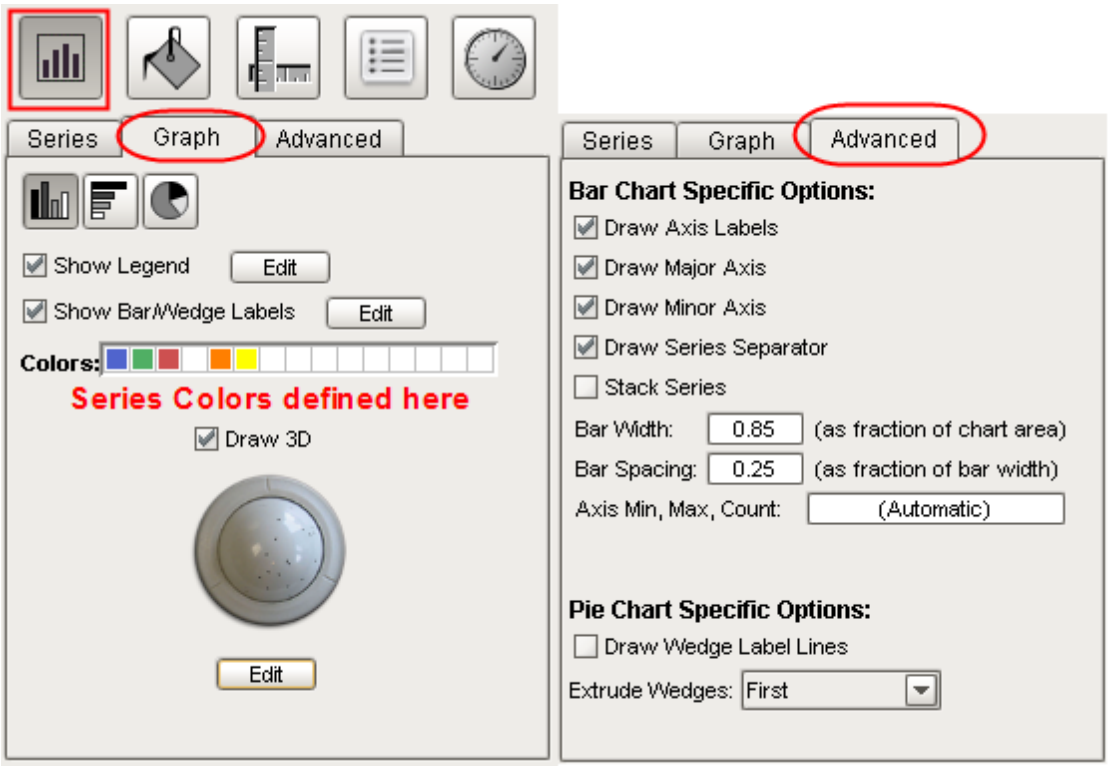
Draw 3D	Render your graph in a three dimensional format.



Embedding Graphs in a table row

Graphs can be embedded in table rows. Leave the Dataset Key blank to have access to the data provided at that level of grouping! This technique is demonstrated in Tutorial #2.

Since a graph is generally a large shape, you usually want to define an explicit page break for the row that contains the graph, so that the graph won't get chopped off on a page boundary. Select the light gray region to the left of the Group in the Table inspector to do this.

Row Label Switch Versions

Row Label Switch Versions are a way to have the graph position labels on each row (Bar in a bar graph, slice in a pie graph). Both examples above use builtin graph labels. The "**Top**" version label on a bar graph will place the label just above the top of the bar on the Y plane for each line. **Middle** and **bottom** work similarly.

You can get to the **switch versions** customizer two ways:

Click on an existing label on the graph. This is illustrated on an image above.

From the graph shape specific inspector, Select the *Graph* tab. Click on **Show Bar/ Wedge Labels**.

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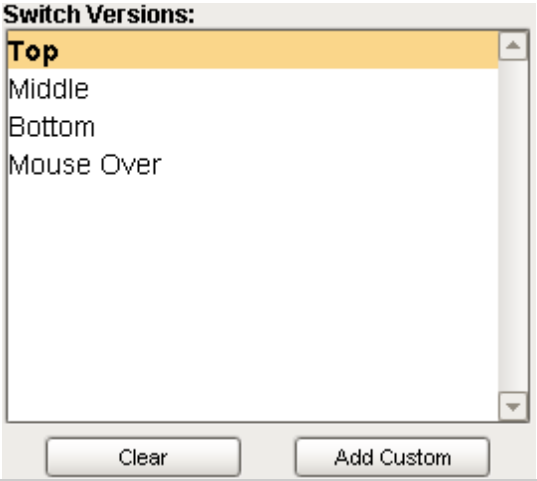

Custom Children

The Graph shape supports additional custom children. Add axis labels or arbitrary text by superselecting the graph and using standard tools such as Text, Rect, Polygon, etc. You can reference keys in added text children which will be evaluated against the group of objects provided for the graph.

TIP	The best way to get the hang of graphs is to create a huge one and experiment with it.

5.8.4.2.8 Dataset Key - Table or Graph

Let's go through the process of creating a simple table! We will cover: getting data into the report, creating a table, defining data, and explore basic parts. Make sure you understand how the Dataset key defines the table's DataSet.

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Date	Equipment	Downtime	User entered comment
Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

Summary goes here

Resulting Basic Table

Getting data into the report

Before creating a useful table, you must get the data from the SQL database into the Report Viewer.

Example downtime data can be retrieved with the following SQL query:

```
SELECT * FROM downtime;
```

downtime_ndx	t_stamp	equipment	time	comment
1	2005-12-20 17:55:00	labeler	50	Out of labels
2	2005-12-22 11:55:00	filler	15	Scheduled maintenance
3	2006-01-02 22:55:00	palletizer	10	Misalignment
4	2006-01-03 02:55:00	conveyor line	25	backup
5	2006-02-12 06:13:00	labeler	10	
6	2006-02-12 12:01:00	labeler	3	Out of labels
7	2006-02-12 14:01:00	palletizer	17	Misalignment
8	2006-02-12 16:23:00	conveyor line	23	Scheduled maintenance
9	2006-02-12 20:04:00	filler	33	Overflow
10	2006-02-12 20:13:00	labeler	21	Stuck labels
11	2006-02-12 20:25:00	filler	20	Overflow
12	2006-02-12 20:36:00	conveyor line	30	Scheduled maintenance

Populate the Report Viewer's default dynamic dataset, *Data*.

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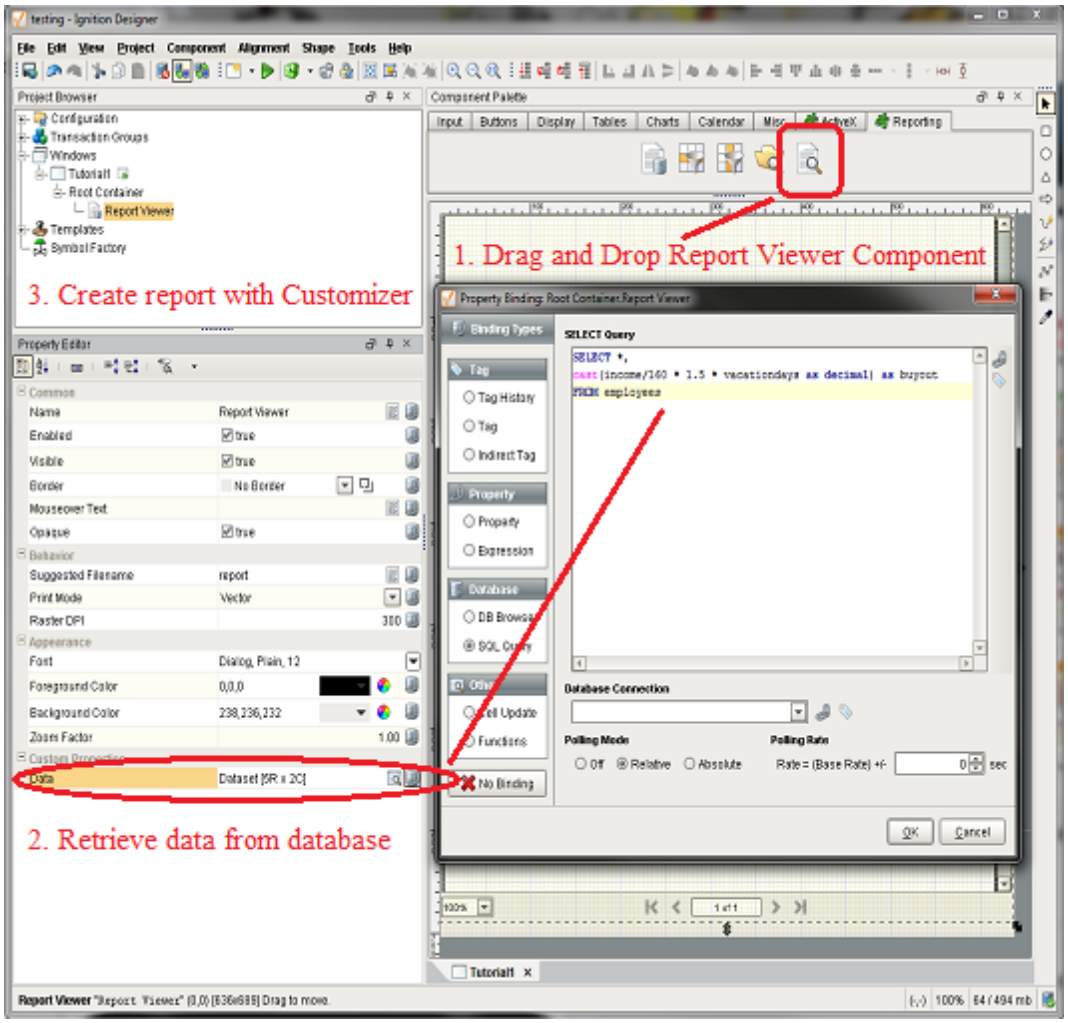

(Illustration from Tutorial #1).

Your report now has data. You're ready to create a table!

Creating a Table

1. Open the Report Designer by selecting the Report Viewer in the Ignition Designer and applying the customizer (Cntl+U).
2. Click the table icon on the add shapes button of the toolbar.
3. Size and position table as desired.

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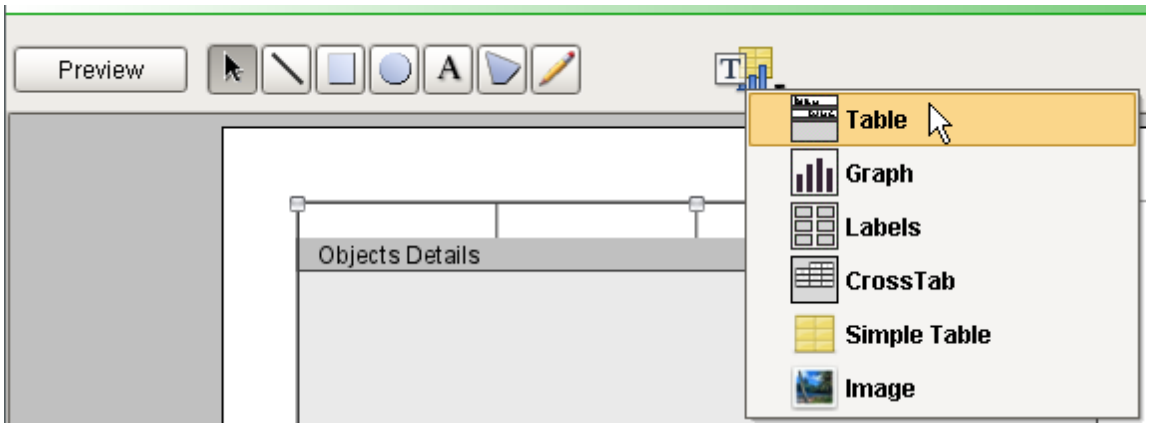
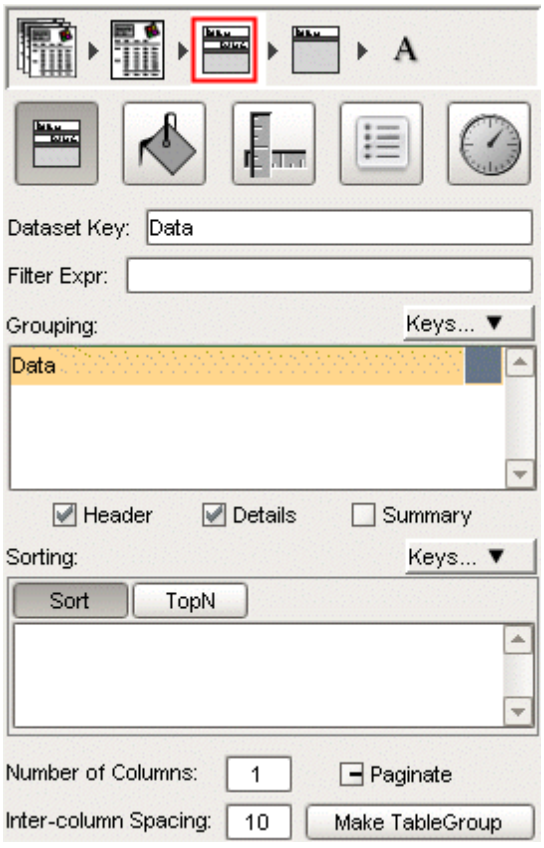


Defining Data

The **Dataset Key** is the name of the DataSet that a table or graph is getting its input from. *@yourSubstitutionKey@* in the table with a defined Dataset key will work as if it were *@DataSet_Key.yourSubstitutionKey@*

1. Click the table to select it
2. Select the Table Inspector



3. Under **Dataset Key:**, type *Data* or drag the *Data* DataSet from the Keys Attribute Panel, choose **table** and click ok. This is the step that defines which DataSet this table will use. You may only define one per table. If you created the table by

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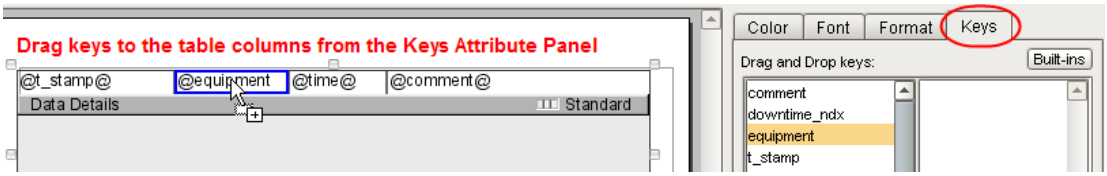
dragging the DataSet, you will not need to fill in the **DataSet Key** in the next section.

With a defined dataset key, your table can reference that data without explicitly defining the path. For example, in this table, **@Data.comment@** is the same as **@comment@**.

4. Drag Keys to the table columns from the Keys Attribute Panel. We appended the string "minutes" to the time label and formatted the date.



5. Click Preview to view your table.

Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

6. Click "Header" and "Summary" check boxes in the Table Inspector. Add text labels to Header and Summary.
7. Select **Data Header**, add a Fill Color (Background) in the Fill & Stroke Inspector.
8. Select **Data Details**, add a Stroke Color (Outline) in the Fill & Stroke Inspector.
9. Adjust text, fill, and stroke as desired.
10. Click Preview to view your table.

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Date	Equipment	Downtime	User entered comment
Dec 20, 2005 17:55	labeler	50 minutes	Out of labels
Dec 22, 2005 11:55	filler	15 minutes	Scheduled maintenance
Jan 02, 2006 22:55	palletizer	10 minutes	Misalignment
Jan 03, 2006 02:55	conveyor line	25 minutes	backup
Feb 12, 2006 06:13	labeler	10 minutes	<NA>
Feb 12, 2006 12:01	labeler	3 minutes	Out of labels
Feb 12, 2006 14:01	palletizer	17 minutes	Misalignment
Feb 12, 2006 16:23	conveyor line	23 minutes	Scheduled maintenance
Feb 12, 2006 20:04	filler	33 minutes	Overflow
Feb 12, 2006 20:13	labeler	21 minutes	Stuck labels
Feb 12, 2006 20:25	filler	20 minutes	Overflow
Feb 12, 2006 20:36	conveyor line	30 minutes	Scheduled maintenance

Summary goes here

Anatomy of a Table

There aren't many parts to a table.

You have the entire table to define the region on the report that the table occupies. Much area of simple tables often end up as a placeholder.

Header, detail, and summary rows are optional for each level of Grouping.

The Table Inspector and Table Row Inspector are where table configuration occur.

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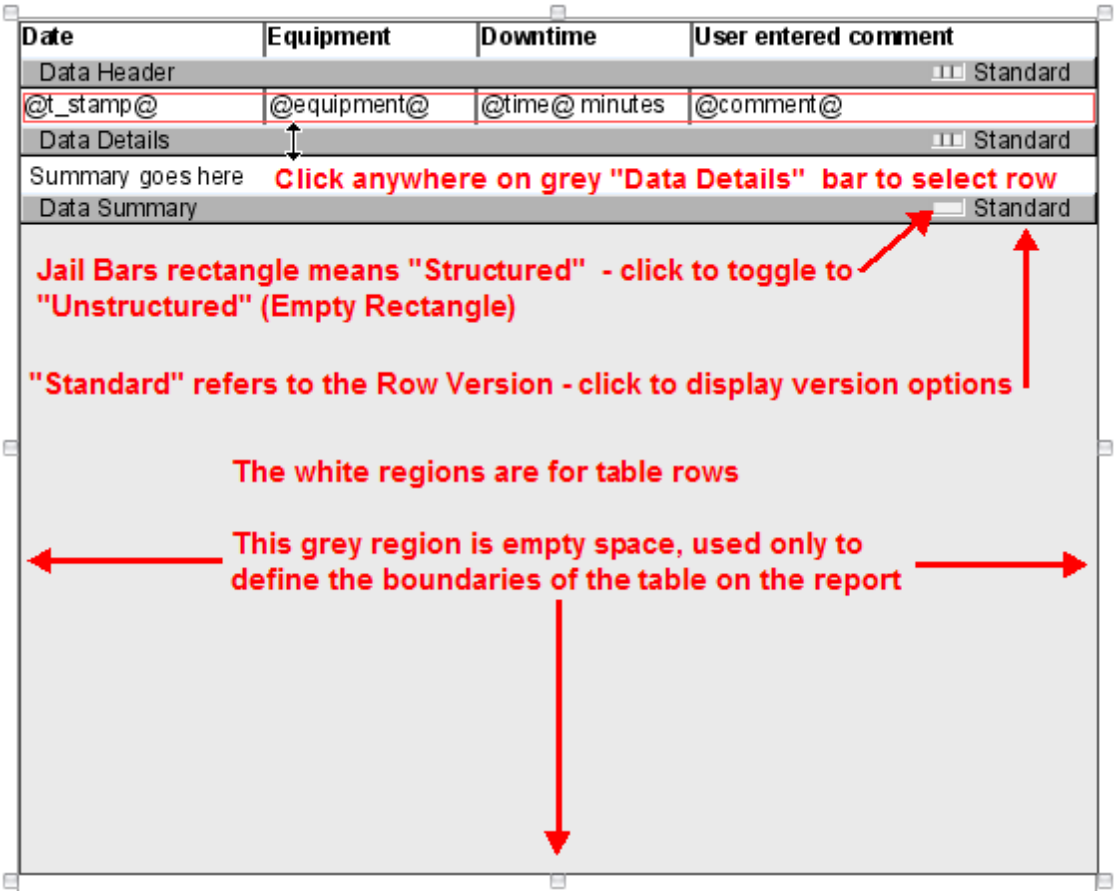
Date
Equipment
Downtime
User entered comment
Data Header
Standard
@t_stamp@
@equipment@
@time@ minutes
@comment@
Data Details
Standard
Summary goes here
Click anywhere on grey "Data Details" bar to select row
Data Summary
Standard
Jail Bars rectangle means "Structured" - click to toggle to "Unstructured" (Empty Rectangle)
"Standard" refers to the Row Version - click to display version options
The white regions are for table rows
This grey region is empty space, used only to define the boundaries of the table on the report

Previous (Table Overview) Next (Table Rows)

TIP Tables can also be created by dragging a DataSet to your report. This will automatically set the **Dataset Key**.

5.8.4.3 Advanced

5.8.4.3.1 BLOB images

Blob (**B**inary **L**arge **Ob**ject)is a data type for storing large amounts of binary data in an SQL database. *Ignition Reporting* can use Blobs to display dynamic images within reports. This example will illustrate using blobs with MySQL and the free MySQL Query Browser.

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Dept Image	First	Last	Department
	Joe	Blogs	ADMIN
	Julia	Hinderson	ENGINEERING
	Adam	Blackwell	ENGINEERING
	Robert	Hill	SALES
	Brian	Green	ADMIN
	Elaine	Short	SALES
	Tim	Moore	ENGINEERING

Using an *Image Placeholder* and blobs to dynamically illustrate table row based on **department**.

Example

We begin with the **employee** table from Tutorial #1 and **emp_images**, a table that maps departments to images

Employee data can be retrieved with the following SQL query:

```
SELECT * FROM employees;
```

	first	last	department	lastSell	income	withholdings	vacationdays
1	Joe	Blogs	ADMIN	2002-05-13 00:00:00	46000	5000	22
2	Julia	Hinders...	ENGINEERING	2005-01-01 00:00:00	121000	10000	19
3	Adam	Blackwell	ENGINEERING	2004-02-05 00:00:00	96000	8000	6
4	Robert	Hill	SALES	2004-05-02 00:00:00	35000	200	27
5	Brian	Green	ADMIN	2004-03-15 00:00:00	55000	4000	1
6	Elaine	Short	SALES	2006-05-05 00:00:00	32000	2000	5
7	Tim	Moore	ENGINEERING	2005-12-15 00:00:00	73000	4000	10
8	Chris	McDade	ENGINEERING	2006-07-01 00:00:00	52000	4000	31
9	Andrea	Sanchez	SALES	2006-01-01 00:00:00	73000	5000	16
10	Thomas	Jones	SALES	2006-09-15 00:00:00	115000	12000	4
11	Jeffrey	York	SALES	2006-02-15 00:00:00	69000	1000	18
12	Michael	Bolton	SALES	2004-12-01 00:00:00	29000	500	35
13	Edward	Oscar	ADMIN	2005-12-31 00:00:00	61000	3000	3

Images data can be retrieved with the following SQL query:

```
SELECT * FROM emp_images;
```

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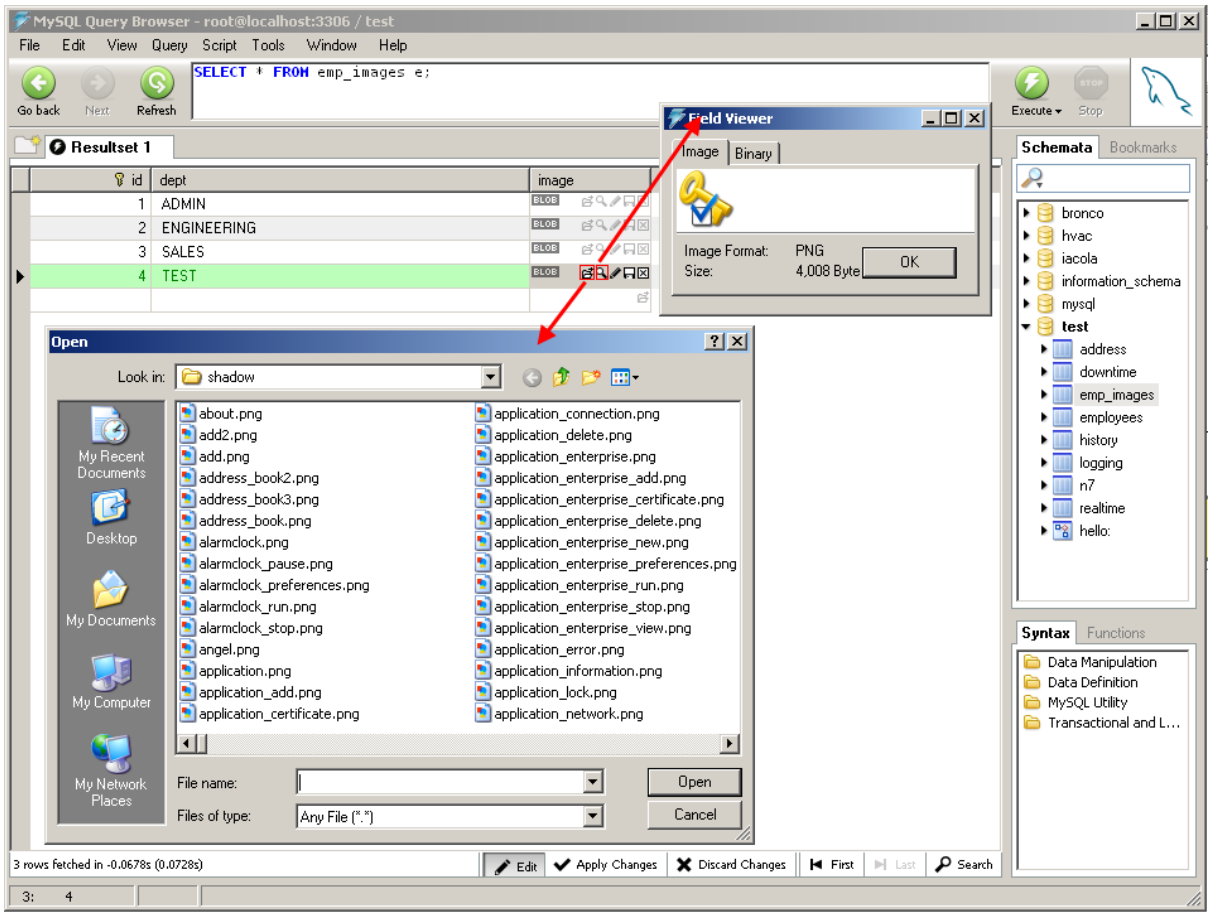

The MySQL Query Browser allows you to upload files as Blobs and view images

The following query will SELECT employees with the image as defined by their department

```
SELECT e.first, e.last, e.income, e.department, i.image FROM employees e,
emp_images i WHERE e.department = i.dept;
```

first	last	income	department
Joe	Blogs	46000	BLOB
Julia	Hinderson	121000	BLOB
Adam	Blackwell	96000	BLOB
Robert	Hill	35000	BLOB
Brian	Green	55000	BLOB
Elaine	Short	32000	BLOB
Tim	Moore	73000	BLOB
Chris	McDade	52000	BLOB
Andrea	Sanchez	73000	BLOB
Thomas	Jones	115000	BLOB
Jefffrey	York	69000	BLOB
Michael	Bolton	29000	BLOB
Edward	Oscar	61000	BLOB
Nathan	Zirkowski	NULL	BLOB

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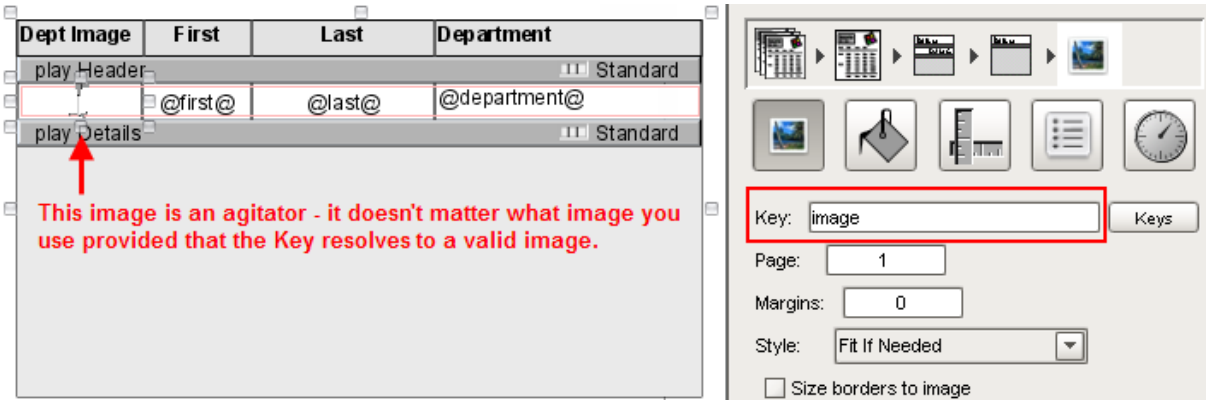
Create a table. Select a column and create an image in it. Set the **Key** value to your key, *image*



Here's what the table looks like with dynamic images

Dept Image	First	Last	Department
	Joe	Blogs	ADMIN
	Julia	Hinderson	ENGINEERING
	Adam	Blackwell	ENGINEERING
	Robert	Hill	SALES
	Brian	Green	ADMIN
	Elaine	Short	SALES
	Tim	Moore	ENGINEERING

5.8.4.3.2 Image Placeholders

Create images by clicking on the image button on the add shapes button of the toolbar. Double click on an image in the **Image Browser** window.

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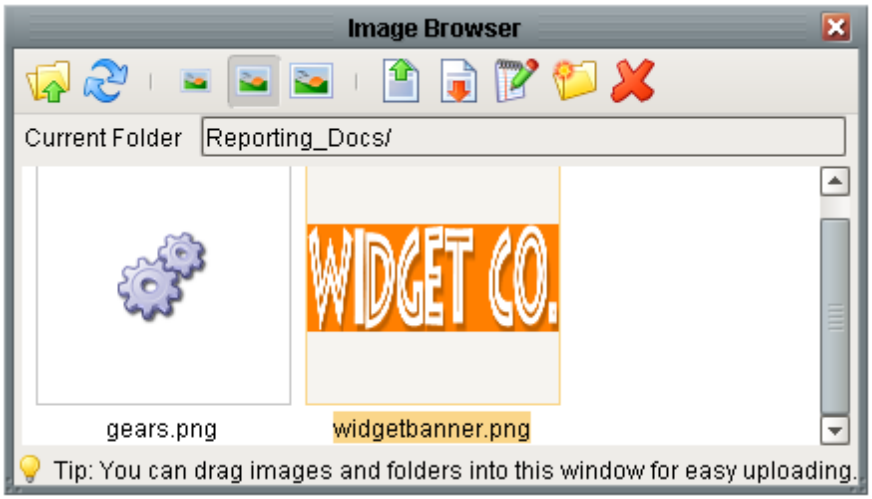

Image Options

Image options are specified in the shape specific inspector for images.

Option	Function
Key	Specify a string expression that returns an image path to change the image. Useful for a multistate image within a table.
Page	Applicable to pdfs only. Selects page number of multipage pdf to display.
Margins	Specifies how many pixels you want of margins around the image.
Style - stretch	Stretches the picture to the image object's size, regardless of aspect ratio.
Style - tile	Tiles the original sized picture within the image object, cutting off sides as necessary.
Style - fit	Resizes picture to image object maintaining aspect ratio.
Style - fit if needed	Resizes picture to image object maintaining aspect ratio, shrinking if necessary, but never enlarging.
Size borders to image	Applicable to **fit** and **fit if needed**.
Rounding Radius	Turns stroke (border) from rectangle, to rounded rectangle, to circle as the number is increased.

Image Placeholders

Images can be populated with BLOB data from an SQL database. They are referred to as *Image Placeholders* when used in this fashon. Simply define the **Key** to the Blob image.

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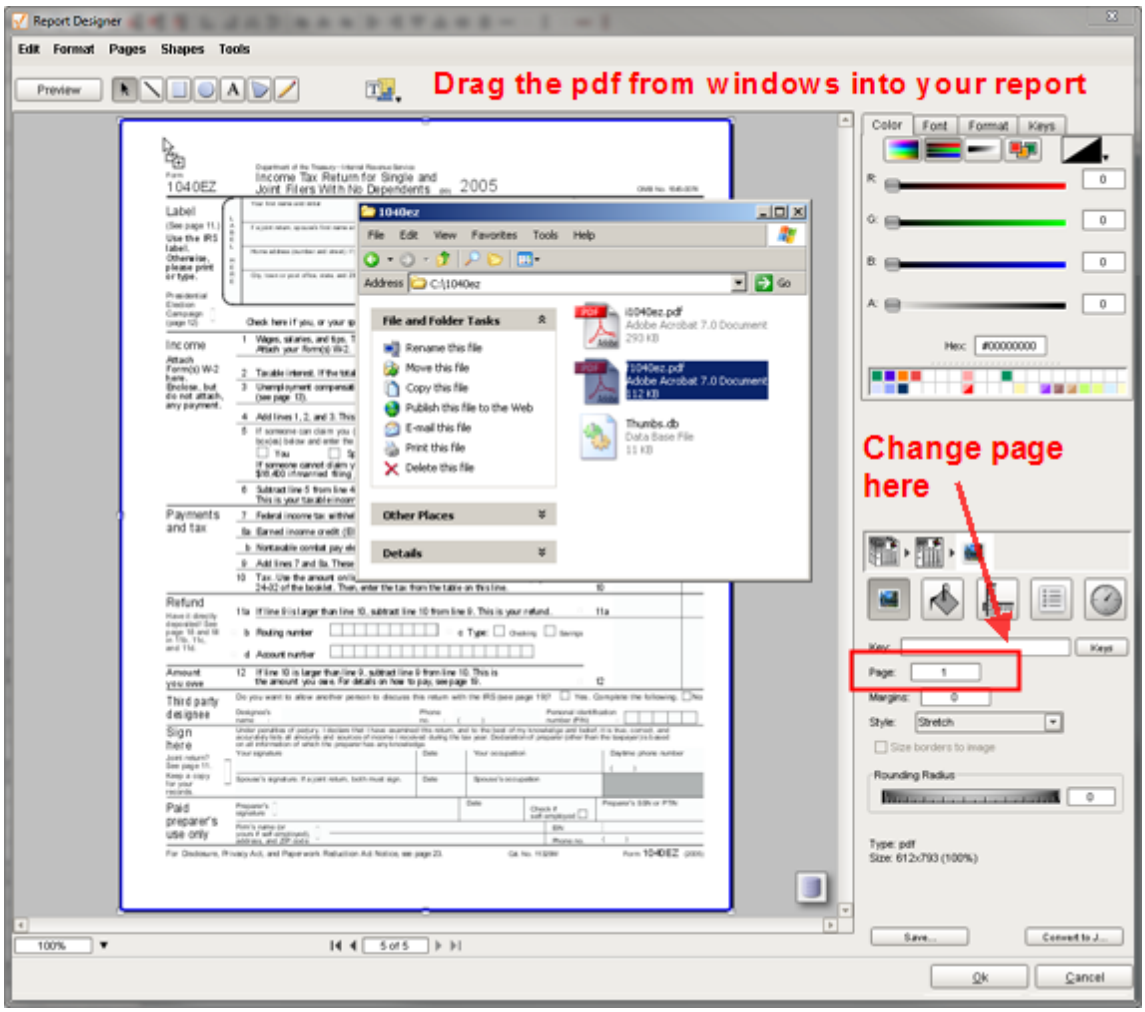
Dept Image	First	Last	Department
	Joe	Blogs	ADMIN
	Julia	Hinderson	ENGINEERING
	Adam	Blackwell	ENGINEERING
	Robert	Hill	SALES
	Brian	Green	ADMIN
	Elaine	Short	SALES
	Tim	Moore	ENGINEERING

Using an *Image Placeholder* and blobs to dynamically illustrate table row based on **department**.

Using Adobe Acrobat (PDF) files

Pdf files are typically used when you have an existing report that you wish to create dynamically. Simply drag text labels or even tables on the pdf to generate a "filled in" report.



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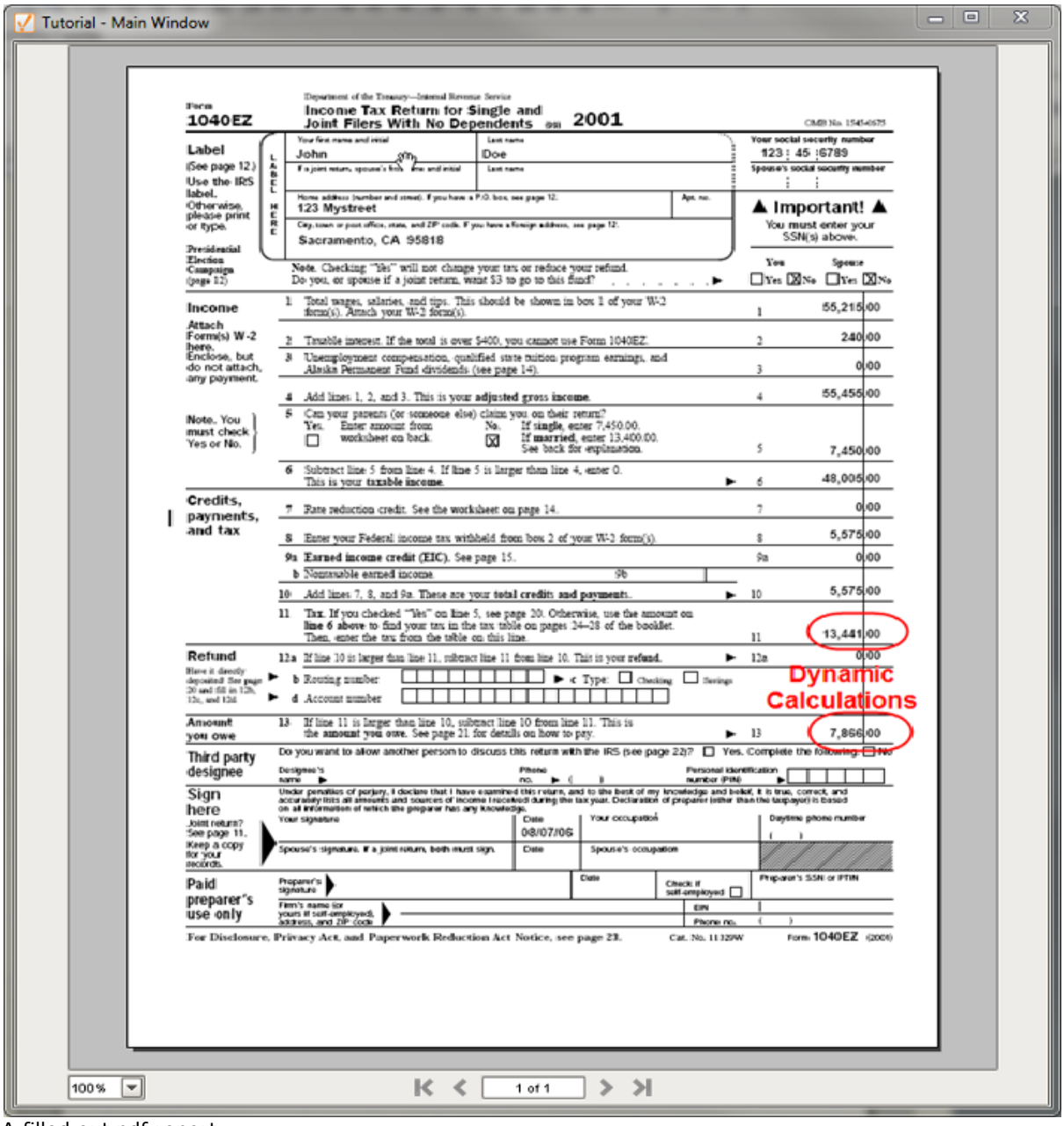
Tutorial - Main Window
Form 1040EZ
Income Tax Return for Single and Joint Filers With No Dependents 2001
Dynamic Calculations
100%
1 of 1

A filled out pdf report

TIP	Extract only the pdf pages that you are going to use before putting them into your report.

5.8.4.3.3 Property Expressions

Property Expressions are a way that you can dynamically change object properties based on key expressions.

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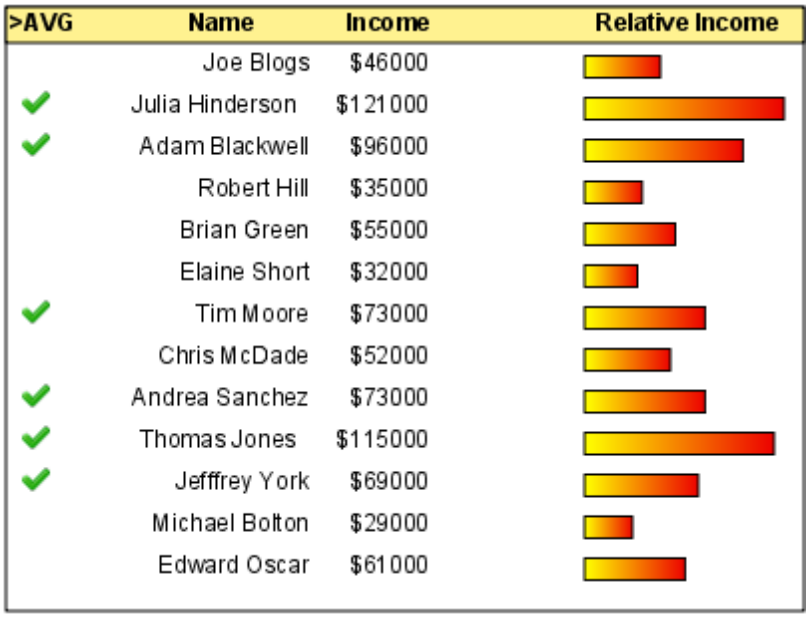

>AVG	Name	Income	Relative Income
	Joe Blogs	$46000	
✔	Julia Hinderson	$121000	
✔	Adam Blackwell	$96000	
	Robert Hill	$35000	
	Brian Green	$55000	
	Elaine Short	$32000	
✔	Tim Moore	$73000	
	Chris McDade	$52000	
✔	Andrea Sanchez	$73000	
✔	Thomas Jones	$115000	
✔	Jefffrey York	$69000	
	Michael Bolton	$29000	
	Edward Oscar	$61000	

A few simple tricks using *Property Expressions*

Properties

Option	Function
URL	Used for Macromedia Flash based reports. Presently N/A.
IsVisible	1 makes the shape visible, 0 makes the shape invisible.
Font	String based font name to use. Property should evaluate to a string that is a font name in the Font Attribute Panel.
FontColor/ FillColor/ StrokeColor	Changes color of font, fill, and stroke, respectively. Expects colors by **name** or "**#RRGGBB**" (Hex) format.
X/Y	Object position that expects a number.
Width/Height	Dynamically Size an object

Simple Example

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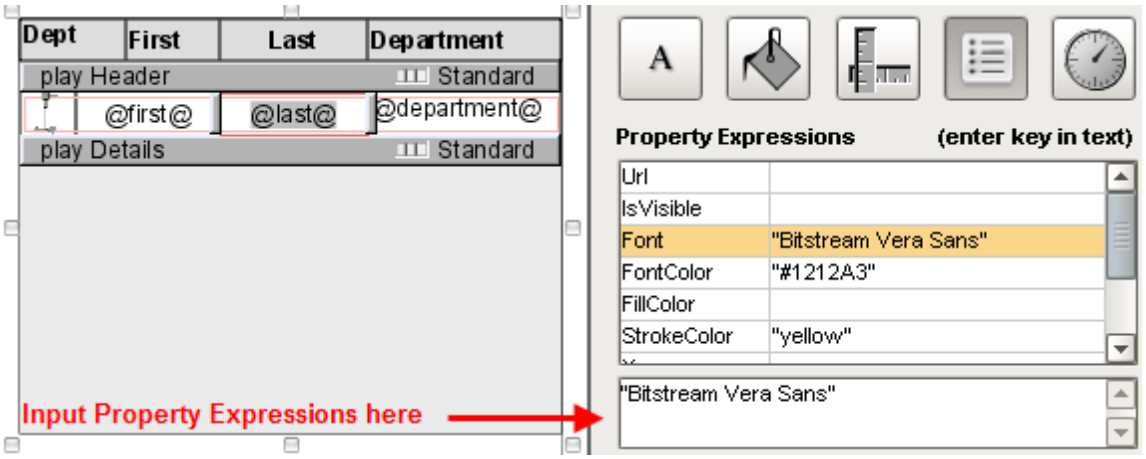

Playing with *Property Expressions* to illustrate their use.

Dept Image	First	Last	Department
	Joe	Blogs	ADMIN
	Julia	Hinderson	ENGINEERING
	Adam	Blackwell	ENGINEERING
	Robert	Hill	SALES
	Brian	Green	ADMIN
	Elaine	Short	SALES
	Tim	Moore	ENGINEERING

Dynamic Example

We will use 2 object's *Property Expressions* to illustrate their uses.

Add an image of a check box. This is included under Builtin/icons/check2.png.

We want a check box is the employees income is greater than the arithmetic average of employees.

Set the *isVisible* property to "**income > Up.average.income**". Notice that we neglect the **@** for properties in the Inspector Panel.

Add a rectangle with a gradient fill.

We want the width of the rectange to be 100 pixels * the ratio of the employee's income versus the employee with the max income.

Set the *Width* property to "**100 * income / Up.max.income**"

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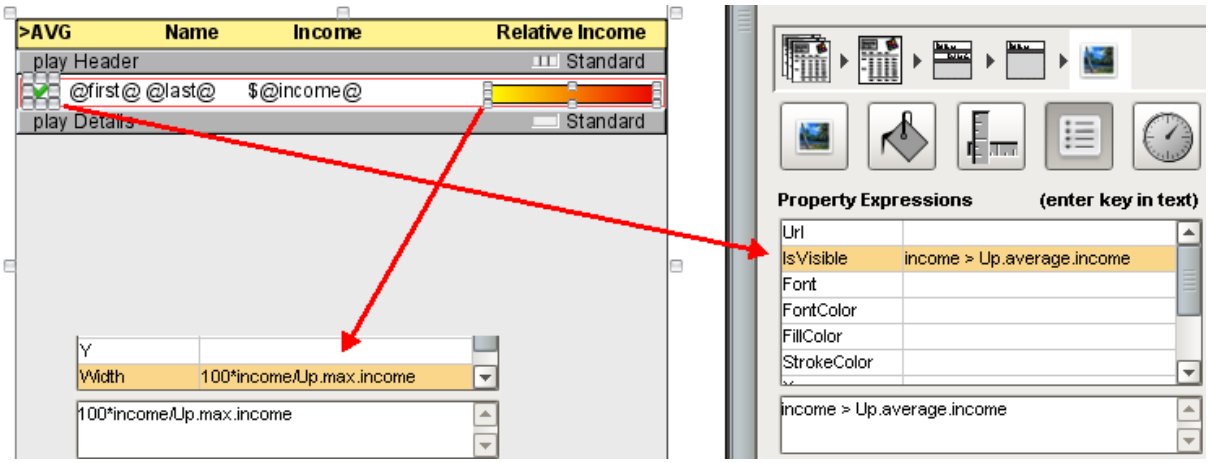

Playing with *Property Expressions* to illustrate their use.

>AVG	Name	Income	Relative Income
	Joe Blogs	$46000	
✔	Julia Hinderson	$121000	
✔	Adam Blackwell	$96000	
	Robert Hill	$35000	
	Brian Green	$55000	
	Elaine Short	$32000	
✔	Tim Moore	$73000	
	Chris McDade	$52000	
✔	Andrea Sanchez	$73000	
✔	Thomas Jones	$115000	
✔	Jefffrey York	$69000	
	Michael Bolton	$29000	
	Edward Oscar	$61000	

TIP Get creative with property expressions. They're very powerful!

5.9 Alarm Notification Pipelines

5.9.1 Overview

Alarm notification pipelines are the bridge between alarms becoming active or clear (broadly called an alarm event) to messages being sent out to users. Pipelines are a graphical mechanism for building up logic, providing an easy to use drag and drop mechanism for creating complex notification scenarios. Using pipelines, it is possible to accomplish many tasks, such as alarm escalation, notification consolidation, conditional dispatch, and more.

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Building Pipelines

Pipelines are created in the Ignition designer under the "Global" node of the Project Browser. Alarm Pipelines, unlike other types of resources such as windows and transaction groups, are *global* resources, and are not part of a project. A defined pipeline will run in the gateway, and you will see the same pipelines available to edit regardless of the project that is currently open.

When you create a new pipeline, or select on to edit, the designer switches to the *pipeline workspace*. The workspace is basically blank canvas, upon which you arrange and connect together various *pipeline blocks*. Each pipeline block has an input, and potentially has outputs. Using the mouse, you can draw connectors between the output of one block into the input of another. The *starting block* is the only fixed part of the workspace. It represents the entry point for alarm events into the pipeline, and is treated like an output block.

Multiple outputs can be connected to a single input. Also, it is perfectly acceptable to write the output of a downstream block back to the input of an earlier block, creating a loop. Of course, some care should be taken when doing this, as it can easily result in unexpected behavior, like sending out many emails for one event!

Pipeline Blocks

Blocks are described individually in the next section, but here is a brief overview:

Notification - Delivers a notification through the selected Notification Profile.
Delay - Blocks the alarm event for the specified amount of time
Expression - Evaluates an expression that results in either "true" or "false", and forwards the event to that output.
Splitter - Forwards a single event concurrently to multiple other blocks.
Switch - Evaluates a non-boolean expression, and forwards to an output based on the result.
Set Property - Evaluates an expression, and sets the result as a runtime property on the alarm event.
Jump - Forwards the alarm event to a different pipeline.

Pipeline Properties

Pipelines themselves have very few settings, but they are important. They can be seen/modified by clicking on the pipeline workspace anywhere there isn't a block.

Enabled - Whether or not the pipeline is allowed to receive events.
Dropout Conditions - These dictate when alarms fall out of the pipeline. There are three possible conditions: Cleared, Acknowledged, and Shelved. If any of the selected conditions become true for an event in a pipeline, it will "drop out" entirely, no matter where it is at. No further action will be take for that event.

Event Flow

Understanding how events flow through pipelines is crucial to leveraging them fully. Alarms are configured on individual tags, and each alarm can specify a target pipeline for active and clear conditions. When the condition for that alarm is met a new alarm event is generated and sent to the entry point of the associated pipeline. The alarm event then moves through the different logical elements of the pipeline until it finally reaches a pipeline endpoint, or until the alarm matches the pipeline's dropout condition, upon which it then exits the pipeline. There can be multiple alarm events in a pipeline at any given point in time and you can view the current status of the pipeline from the Alarm Pipelines status screen in the Ignition Gateway. It is possible to forward events from one pipeline to another, making it possible to create multipurpose and reusable pipelines.

Each alarm event progresses sequentially through the blocks of a pipeline. However, multiple alarm events can exist in parallel in the pipeline, and new events may enter the pipeline at any time. Some

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block settings may result in alarm events being held up, such as consolidated notification, but one alarm event cannot affect other events in the pipeline. In this particular case, when multiple events will be collected together for notification, the events that don't drop out of the pipeline after notification are individually forwarded to the output of the block.

At every transition, and occasionally inside of the block execution as well, the dropout conditions will be evaluated. If the event no longer meets the conditions, it will drop out of the pipeline. It is crucial to understand how this works in order to understand pipeline execution. For example, a common scenario is to place a Delay block directly in front of a Notification block. If the delay is 5 minutes, and "Clear" is one of the pipeline drop out conditions, it effectively means that only events that stay active for longer than 5 minutes will actually result in notifications. If acknowledge is one of the dropout conditions, it would mean that operators (or anyone viewing alarm status) would have 5 minutes to acknowledge them, and only then would notifications be sent.

Event Instances and Runtime Properties

As mentioned, a new "alarm event" is generated each time an alarm transition to active. This event consists of core data, but also has arbitrary properties available on it. The alarm configuration properties are available, as well as associated data, but in addition there are "runtime properties", that only exist while the alarm event is in memory, and are only used by pipelines. These properties can be accessed by several block types, and runtime properties can be created and updated with the "Set Property" block type.

During an alarm event's lifetime, its properties may be updated at any time. When an alarm goes to clear, for example, the system sets information about that state on the alarm event. In the pipeline, if a block accessed the "state" property, it would see a different value than if it had checked just moments earlier.

It may be possible for a specific alarm event to exist multiple times in a pipeline. This is especially true when using the splitter block, which takes events and forwards them concurrently to multiple outputs. When this occurs, the alarm event is "branched" and a new "event instance" is created. Each event instance will start with identical properties, but future modifications of properties will only affect the particular instance. All instances of an event will properly reflect properties set later by the system, such as acknowledgement or clear state.

Pipeline Lifecycle

Given the potentially long running nature of pipelines, it's important to understand how they operate when you edit them. Each pipeline normally has only one instance running at a time, which handles all of the events that go into it. When you edit a pipeline and save, however, a new instance is instantiated. The old instance is "retired", but *continues to run* until all of the existing events are done. The new instance only receives events generated after the time that it was created, it does not take over the previous instance's events.

5.9.2 Alarm Properties

An alarm event is made up of many pieces of information. The state, the value, the time, all of the configuration data for the alarm, and more are collectively known as the *properties* of the event. A "property" is generally a name, potentially along with a default value. There are many properties that an alarm may have, and if the property isn't present, the default value is usually assumed.

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How Properties are Used
Properties are used in a number of ways:
To define how an alarm behaves
Referenced in messages, such as the body of an email, or sms message.
Referenced in expressions, such as in the binding of a different property, or in an expression block.
Created and used in pipelines as temporary variables, such as to make a counter.
... and various other places

While properties are always accessed the same (for example by using the "{propertyName}" syntax in a message or expression, or the getProperty() expression function), there are some subtle variations on where the property value comes from, and what it's lifecycle will be. To understand this better, consider that an Alarm Event has the following structure:

Alarm Event
Active Event Properties
Clear Event Properties
Acknowledged Event Properties
Runtime Properties

The first three collections of properties get created when the described type of event occurs. Consequentially, it's possible for the same property to exist multiple times in an Alarm Event. For example, a bound configuration property or associated data is captured on both the active and clear events. When you reference a property, the alarm event will provide you with the most recent value. So, if you have a bound property call "MyData", and you reference it when the alarm is active, you may get a different result than when the reference is executed later and the alarm has cleared. The individual values are stored separately in the alarm journal, however.

As described in the previous section, Runtime Properties are different in that they only exist while the alarm event is in memory (still "live", that is, not cleared, or not acknowledged). They do not get stored in the alarm journal. In addition to properties created through the Set Property block, the system also has a number of defined runtime properties that it may use for various purposes. Though these are used internally, they are technically still regular properties, and can be accessed and modified through the normal means.

Commonly Used Properties

Configuration
Name - The name of the alarm (ie. not of the tag)
Enabled
Priority
DisplayPath
ActivePipeline, ClearPipeline
TimeOnDelaySeconds, TimeOffDelaySeconds
Notes

Runtime (generated for the event)
IsInitialEvent - Set to "true" when the event is caused by the initial state of the alarm.
SystemAck - Set to "true" when the alarm has been acknowledged by the system, due to an overflow of the "live event queue". Live events are alarm events that are active or not acknowledged, and are limited for each alarm by the general alarm settings.
IsShelved - Is the alarm currently shelved?
ShelfExpiration - When the shelf will expire for this event.
EventCanceled - If set, the event will drop out as soon as possible from the pipelines.

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EventId - the unique id (uuid) of this alarm event. Each event gets a completely unique id.
Source - the qualified path to the item that generated this event.
DisplayPathOrSource - Gets the display path if defined, otherwise returns the source.
State - The current overall state of the alarm: ClearUnacked (0), ClearAcked (1), ActiveUnacked (2), ActiveAcked (3)
EventState - The transitional state that caused the current event: Active (0), Clear (1), Ack (2)
EventValue - The value associated with the current event.
AckUser - The user who acknowledged this event.
IsAcked - "True" if the event has been acknowledged.
IsActive - "True" if the event is still active.
IsClear - "True" if the event is *not* still active.
ActiveTime, ClearTime, AckTime - The timestamp for each event.
PipelineTransitionCount - How many transitions the event has made inside of the pipelines.

5.9.3 Pipeline Blocks

Enter topic text here.

5.9.3.1 Notification

As the name suggests, the Notification Block is responsible for actually sending notifications. Each notification block can target one particular *notification profile,* which represents one method of notification, such as email, sms, or voice. Each type of notification profile will have its own relevant properties for configuration, although some features are common to all profile types. The various profiles will also behave differently, according to their capabilities, in regards to how notifications are ordered. For example, the email profile is capable of sending a message to many recipients at once, while the SMS and voice notification profiles must step through each contact sequentially.

Basic Setup

There are two required settings for notification blocks: the notification profile to use, and the On-Call Roster to use. The profile will dictate the method through which notifications occur, and the roster will dictate who receives the notifications. The call roster provides an ordered list of contacts, which will first be pared down according to each user's schedule. The resulting contacts will be notified in order, based on how the profile operates.

The settings displayed will depend on the type of profile selected.

Email Settings
From Address - Email address used for the "from" field.
Subject - The subject of the email. May refer to properties of the alarm, such as name, value, etc.
Message - The body of the email. Like the subject, may refer to properties of the alarm.
Consolidated Message - The message sent when consolidation is turned on, and more than one alarm is being sent. Can refer to properties, and additionally support a special expansion syntax of "{{ ... }}", where everything inside of the double curly braces will be repeated for each alarm in the consolidation group.
Test Mode - If enabled, logs to the console each time an email would be sent, instead of sending the actual email.

Voice Settings
Require PIN - If true, the user will need to enter their PIN in order to hear the alarm notification messages. The user's PIN is defined in the user management section of the gateway. If false, the any user will be allowed to hear the messages after answering.
Allow Acknowledgement - If false, users will only be allowed to listen to alarms, not to acknowledge

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them.
Delay Between Calls - Introduces a delay between calling each contact, for each alarm. The pipeline dropout conditions are checked regularly between calls and while waiting, so this would provide time for the alarm to drop out before calling the next person. The delay is only enforced after following a "successful" call (a call that was answered). Unanswered or errored calls will move on to the next contact right away. Please note that long delays can block other alarms in the call queue. The delay is applied to all contacts for a particular alarm, so using "fair scheduling" (enabled in the gateway configuration) can help reduce blockage by interleaving different alarm notifications.
Test Mode - If enabled, messages will be logged to the console indicating when and to whom calls would have been made, without actually making a call.

SMS Settings
Message - The message to use for single events.
Consolidated Message - Like email, the message to use when multiple events are sent together, due to the block's consolidation settings.
Delay Between Notification - As with voice, a delay between each message sent, to give the recipient time to acknowledge and prevent further notification.
Test Mode - If enabled, logs messages that would have been sent to the gateway console, and does not actually send them.

Consolidation

Notification consolidation allows you to limit the number of notifications sent by specifying a delay during which incoming events will be collected. When the delay expires, all events that have arrived during the period of time will be sent together to the notification profile. The manner in which the profile implements consolidation will vary, but in general the result will be a shorter message, or fewer messages, than would have occurred otherwise.

Consolidation is defined with two parameters:
Delay - How long to wait after the first eligible alarm arrives for other alarms. In other words, if an alarm comes in and would pass the frequency setting, it will be delayed for this amount of time.
Frequency - The max frequency with which the profile can send alarms. This setting works in conjunction with the delay.

The delay is used to protect against situations where an event might generate many alarms together, while the frequency is used to ensure that contacts aren't notified too often, for example if an alarm is rapidly going in and out of the active state.

5.9.3.2 Delay

The delay block simply blocks events for the specified amount of time before forwarding them to the next block. They are generally used to wait for the dropout condition to become satisfied for an alarm. For example, a 5 minute delay might be used to give operators viewing control screens a chance to acknowledge, and only send notifications if they haven't (the "active delay" deadband on the alarm could be used to delay the alarm as well, but in that case it wouldn't actually be active, and therefore not displayed, for the delay time).

Delays are often also used to control flow in a pipeline. For example, in an "escalation" scenario, a notification block might be used to send emails. Since emails are sent instantly, and acknowledgement occurs "asynchronously" (the user must see the email and click the link or log into the system), a delay block could be used to provide time for the user to acknowledge, before moving on to a voice notification block.

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There is no practical limit to how long a delay can be. The delay is calculated independently for each event entering the block, meaning that each event will be held for the specified time.

5.9.3.3 Splitter

The splitter block simply forwards an event to multiple outputs. Any number of outputs can be created. It is **very** important to remember that this block creates a copy of the alarm event for each output and executes them *in parallel.* If care is not taking, it is possible to end up with an exponential number of alarm event copies active in the pipelines at one time.

Since each notification block operates on a specific call roster, splitters are useful for delivering events to multiple notification blocks at once.

5.9.3.4 Expression

The expression block contains an expression which is evaluated against each alarm that enters it. The result is expected to be a boolean value, either True or False. The alarm is passed to the corresponding output.

The expression executed by the block is written in the same syntax as other expressions in Ignition. However, in this context, it is possible to refer directly to properties of the alarm event that is being evaluated by using the standard "{path}" reference syntax. In addition, several functions are available to quickly determine the state of the alarm.

Examples

```
isActive()
```
This single function returns whether the current event is active or not. An expression block like this could be used to then dispatch to an "active" pipeline, and a "clear" pipeline (both the active and clear pipeline settings on the alarm would be set to this dispatch pipeline). This kind of setup allows you to later modify how actives are handled vs. clears in one place, without having to modify many alarms.

```
toInt({priority})>2 && {displayPath} like "*East Area*"
```
This block would forward all High and Critical alarms from the "east area" to the true path. The others would go to false, which may not actually be bound to another block, making this expression block act like a filter.

```
isPropertyDefined("isEscalated")
```
This expression checks if a property exists on the event. The "isEscalated" property is not a system defined property. Instead, in this example, it might be set using a Set Property block before forwarding back to the start of the pipeline. The first time through, this expression would fail, but the next time, it would pass, and the "escalated" behavior could be executed.

5.9.3.5 Switch

The switch block is very similar to the expression block, except that the result of the expression does not need to be a boolean. Instead, it can be a number or string, and it will be looked up against the defined list of expected results. If a match is found, the alarm will follow that path, otherwise the "catch all" output will be used.

For example, imagine that the alarms in the system have associated data for the "Area" that they belong to (the display path could also be used, but would likely contain additional information). If all alarms were

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categorized according to the area, such as "Area 1", "Area 2", then a switch block could be defined as such:
Expression: {Area}
Values:
Area 1
Area 2
Area 3

If an alarm did not have an area, or belonged to a different area, the "catch-all" branch would be used.

5.9.3.6 Set Property

The set property block allows you to define or redefine a property on the alarm event. The value is created from the given expression, which can refer to other properties or the same. As described in the pipeline overview, settings modified in this way will only exist while the alarm is in the pipeline, they will not be stored to the journal, or show up in the status table.

Example:
If you want to attempt notification up to three times before stopping, you could create a pipeline that looked like [Notification Block]->[Set Property]->[Expression], with the expression looping back to the notification block (perhaps with a delay in between).
The Set Property block would look like:
Property Name: counter
Expression: coalesce({counter}, 0)+1

Note that the first time the block is hit, the "counter" property will not exist, and therefore the value will be null. The coalesce function returns the first non-null value, allowing us to start with 0. Another way to write this might be:
`if(isPropertyDefined("counter"), getProperty("counter"), 0)+1`
The "getProperty" function is functionally equivalent to simply referencing the property in brackets (ie "{counter}").

The expression block in this example would simply be: "{counter}<3".

5.9.3.7 Jump

The jump block simply forwards the alarm to a different pipeline.

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Scripting

Part VI

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6 Scripting

6.1 About Scripting

Scripting is used in many places in Ignition to add a significant degree of flexibility and customization where pre-canned options fall short. There are two major scripting languages in Ignition, Python and the Expression Language. It is important to understand the differences between the two, and to know where each is used.

Python Scripting

What is Python?
Most of the time when we talk about "scripting" we're talking about Python scripting. Python is a general purpose programming language that was developed in the early 90's and has gained significant popularity in the 2000's. We like it because it is extremely readable, elegant, powerful, and easy to learn. As an added bonus, it gracefully interacts with Java, giving programmers an extremely powerful tool when paired with Ignition, which is written in Java.

Python or Jython?
You'll often hear Python referred to as "Jython" by advanced users of Ignition. Python is the language, Jython is the *implementation* of the language that we use. Most users of Python use the implementation called "CPython" - they just don't realize it. See http://en.wikipedia.org/wiki/Python_(programming_language)#Implementations

Why not VBA?
Many HMI/SCADA packages use VBA, or Visual Basic for Applications. As such, many engineers switching to our software inquire about it. There are a variety of reasons we don't use VBA:
1. It is not compatible with Java, the language that Ignition is written in. This also means that it is not cross-platform.
2. It is a dying language (Microsoft has phased it out as of July, 2007)
3. It is full of security holes
4. It is an ugly language

Where is Python Used?
Python is used in many places in Ignition. The most apparent place is in component event handlers. Project event scripts are another major place where Python is used.

Which version of Python is Used?
Ignition uses Python 2.5. When looking at outside documentation, such as on www.python.org, verify that you are looking at the correct version of the documentation.

Expression Language

The expression language is a simple language that we invented. An expression language is a very simple kind of language where everything is an *expression* - which is a piece of code that returns a value. This means that there are no *statements*, and no *variables* , just *operators, literals,* and *functions.* The most common expression language that most people are familiar with is the one found in Excel. You can have Excel calculated a cell's value dynamically by typing an expression like `=SUM(C5:C10)`. Our expression language is similar. It is used to define dynamic values for tags and component properties.

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6.2 Python

6.2.1 About Python

While it is entirely possible to create a complete and powerful project in Ignition without writing a line of script, many designers will find that in order to complete projects with specific requirements, they need to learn at least a little Python. In our experience, most industrial projects involve lots of very complex and specific requirements.

The good news is that learning Python is easy and enjoyable. Python is one of the most beautiful programming languages we've ever encountered. It is very easy to read - even if you don't know it at all, you will probably be able to understand a basic Python script. It is frequently called it "executable pseudocode". We've included a short tutorial here which should help get you started. If you find yourself doing a lot of scripting, you may want to pick up a basic reference book about Python.

Scripting Help

Scripting is one of the topics in Ignition that users frequently need help with, because it is used to achieve some of the most complex requirements of a project. If you get stuck designing a script, or would like help getting started, don't hesitate to get some help. Our user forum at http://www.inductiveautomation.com/forum is by far the best place for scripting help.

When asking for scripting help - be precise and complete. If you're working through an error - include the text of the error, the circumstances, and the offending code. If you're stuck on something, it is helpful to describe the broader goals of what you're trying to accomplish - there is often an easy way and a hard way. Don't be shy to simply ask for some direction getting started.

☞ Under the hood - Python in Java

The implementation of Python included in Ignition is Jython 2.5. While this is not the "latest" version of Python, it supports the vast majority of what people consider "python". The latest version of Python, version 3, is actually more of a branch, with many significant changes. The vast majority of sample code to be found was written against version 2.

One of the powerful things about using Jython is that your script has access to the entire Java standard library. In the Client, this will be Java 5 or above. When running under the Gateway, this will be Java 6 and above. See Accessing Java for more information.

Many scripting users are blown away by their script's speed. We can't take credit for this - the Jython engine hot-compiles your Jython code to Java bytecode, which means it runs natively in the JVM, which in turn can hot-compile it to machine code. It's fast.

6.2.2 Python Tutorial

6.2.2.1 Basic Syntax

The basic syntax of python is easy to learn, because there isn't much of it.

Hello World

Lets get right to everyone's favorite example: the following script will print out "`Hello World`" to the output console.

```
print "Hello World"
```

The `print` keyword is a handy tool in Python, allowing you to put text into the output console. This is useful for debugging your scripts. You can print multiple things by separating them with commas.

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Variables

Variables are created by simply assigning a value to them. Variables do not need to be declared, because Python has a *dynamic type system*. That means Python figures out the type of the variable on the fly, when the script is executed.

The following script would print out: `15`

```
x=5
y=3
print x*y
```

Strings, Numbers, and Booleans

Literal strings can be typed in using either double quotes or single quotes. This can be handy when your string contains one quote or the other. You can also use the backslash character to escape special characters.

Numbers can just be typed in normally, like `42` or `3.14159`. Python does not have a boolean type. 0 is false and 1 is true. (this is an oversimplification, but should suffice for now). The following prints out "`1`"

```
x="isn't this grand"
y='isn\'t this grand
print x==y
```

The None Value

There is a special value in Python called `None` (with a capital N). This is simply a special value that means: no value. This value is equivalent to Java's `null` value.

Lists

In Python, lists (arrays) are a built-in type that contains multiple other values. Lists can contain any type of items, and the items in a list do not all need to be the same type. You can create a list by enclosing multiple items in square brackets (`[]`), separated with commas. You can pull items out of a list with the square-bracket list index notation. Note that lists are zero-indexed, meaning that the first item in the list is at position 0. This code will print out "`a list`".

```
a = ['this', 'is', 'a list', 8, 93.928]
print a[2]
```

Basic operators

Python has all of the normal **arithmetic operators** you'd expect, addition(`+`), subtraction(`-`), division(`/`), multiplication(`*`), modulus(`%`), etc.

The comparison operators are just like in C: equals(`==`), not equals(`!=`) greater than (`>`), greater than or equal(`>=`), etc.

The **logical operators** are just typed in plain text: `and`, `or`, `not`.

These are just the basics. There are other operators, like bit shift operators. Read about them at: http://docs.python.org/library/stdtypes.html

Comments

Comments start with a hash sign. Add comments to your code so that when you go back to it after a long time, you know what the code is trying to do.

```
# Prints out 'Hello World' 5 times.
```

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```
for x in range(5):
   print 'Hello world'
```

Whitespace

Perhaps its most unique feature, logical blocks are defined by *indentation* in Python. A colon (`:`) starts a new block, and the next line must be indented (typically using a tab of 4 spaces). The block ends when the indentation level returns to the previous level. For example, the following will print out "`5 4 3 2 1 Blast-off`". The final print is *not* part of the loop, because it isn't indented.

```
countdown=5
while countdown > 0:
   print countdown,
   countdown = countdown - 1
print "Blast-off!"
```

6.2.2.2 Control Flow

Control flow are the parts of a language that make it do things differently based upon various conditions. In other words: **if**s and **loops**. Python has all of the basic control flow statements that you'd expect.

`if` Statements

If statement should be familiar to anyone with a passing knowledge of programming. The idea of an `if` is that you want your script to execute a block of statements only if a certain condition is true. For example, this script won't do anything.

```
x = 15
if x < 10:
   print "this will never show"
```

You can use the `if...else` form of an if statement to do one thing if a condition is true, and something else if the condition is false. This script will print out "`this will show!`"

```
x = 15
if x < 10:
   print "this will never show"
else:
   print "this will show!"
```

Lastly, you can use the `if...elif` form. This form combines multiple condition checks. "elif" stands for "else if". This form can optionally have a catch-all "else" clause at the end. For example, this script will print out "three":

```
x = 3
if x == 1:
   print "one"
elif x == 2:
   print "two"
elif x == 3:
   print "three"
else:
   print "not 1-3"
```

`while` Loops

A while loop will repeat a block of statements while a condition is true. This code will print out the contents of the items in the list. This code uses a *function* called `len`, which is a built-in function that returns the length of a list or string.

```
listOfFruit = ['Apples', 'Oranges', 'Bananas']
x = 0
```

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```
while x < len(listOfFruit):
   print listOfFruit[x]
   x = x + 1
```

for Loops

Python's for loop may be a bit different than what you're used to if you've programmed any C. The for loop is specialized to iterate over the elements of any sequence, like a list. So, we could re-write the example above using a for loop eliminating the counter x:

```
listOfFruit = ['Apples', 'Oranges', 'Bananas']
for item in listOfFruit:
   print item
```

Much more graceful! You'll often see the for loop used instead of the while loop, even when you simply want to iterate a given number of times. To do this with the for loop, you can use the built-in function `range`. The `range` function returns a variable-size list of integers starting at zero. Calling `range(4)` will return the list `[0, 1, 2, 3]`. So, to have a for loop repeat 4 times, you simply can do:

```
for x in range(4):
   print "this will print 4 times"
```

break and continue in Loops

You can stop a loop from repeating in its tracks by using the `break` statement. This code will print out "`Loop`" exactly *two* times, and then print "`Finished`".

```
for x in range(10):
   if x >= 2:
      break
   print "Loop"
print "Finished"
```

You can use the `continue` statement to make a loop stop executing its current iteration and skip to the next one. The following code will print out the numbers 0-9, skipping 4

```
for x in range(10):
   if x == 4:
      continue
   print x
```

6.2.2.3 String Formatting

String formatting is a somewhat minor feature of Python, but turns out to be incredibly useful in Ignition. String formatting is used to manipulate strings, specifically to insert the values of variables inside a string without a bunch of concatenation.

The `%` operator is used in Python not just for modulus, but also for string formatting. Suppose we wanted to print a weather report. We could use concatenation, like this:

```
temp = 65.8
city = "Sacramento"
windSpeed = 25
windDir = "east"

print city + " weather: " + str(temp)  + "°F, wind "+ str(windSpeed) + "mph from the "+ windDir
```

Yuck! This kind of concatenation is really a pain to write and to read. With string formatting, we could have written it like this:

```
temp = 65.8
```

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```
city = "Sacramento"
windSpeed = 25
windDir = "east"

print "%s weather: %f°F, wind %dmph from the %s" % (city, temp, windSpeed, windDir)
```

Ah, that's much easier on the eyes. What is happening here is that the `%` operator is applying the variables on its right-hand side to the *format string* on its left-hand side. It looks for placeholders (called *format specifiers*) inside the format string, and replaces them with corresponding values from the variables on the right-hand side. There are various format specifiers that can be used for different types of variable types. If you actually want a % sign inside the final string, use the special format specifier: "`%%`"

Format Specifier	Meaning
`%%`	Inserts a % sign into the final string
`%c`	A single character. Value must be a string of length 1 or an integer
`%d` or `%i`	Signed integer
`%f`	Floating point, decimal format
`%s`	A String, converts the value to a string using str()
`%u`	Unsigned decimal
`%x` or `%X`	Unsigned hexadecimal

You can also put some extra information in the format specifiers between the % and the format specifier character. The most useful thing to do is to specify the number of decimal places to use to print floating point numbers. For example, "`%.3f`" would always put three digits after the decimal point.

6.2.2.4 Functions

Functions are code that can be called repeatedly from other places. Functions can have parameters passed into them, and may return a resulting value. Some functions, like `len`, are built-in. Some functions, like `system.gui.messageBox()`, are part of the scripting libraries provided by Ignition. Some functions, like `math.sqrt()`, are provided by the Python standard libraray.

Functions are `invoked` by using their name followed by an argument list surrounded in parentheses. If there are no arguments, you still need an open and close parenthesis.

Defining Functions

Functions are defined using the `def` keyword. A function needs a name, and needs a list of the arguments that it can be passed. For example, this code defines a function that tests whether or not a number is odd. It returns a true value (1) if the number is odd. It is then used in a loop to print out the odd numbers between 0 and 9.

```
def isOdd(num):
   return num % 2 == 1 # uses the modulus (or remainder) operator

for x in range(10):
   if isOdd(x):
      print x
```

Function Arguments

When a function accepts arguments, the names of those arguments become variables in the function's namespace. Whatever value was passed to the function when it was invoked becomes the value of those variables. In the example above, the value of `x` inside the `for` loop gets passed to the `isOdd` function, and becomes the value of the `num` argument.

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Arguments can have *default values*, which makes them optional. If an argument is omitted, then its default value will be used. The following code defines a function called `cap`, which will take a number, and make sure it is within an upper and lower limit. The limits default to 0 and 100.

```
def cap(x, min=0, max=100):
   if x < min:
      return min
   elif x > max:
      return max
   else:
      return x

# This will print out "0"
print cap(-1)

# This will print out "100"
print cap(150)

# this will print out "150", because it uses a max of 200
print cap(150, 0, 200)
```

Keyword Arguments

Arguments can also be specified by *keyword* instead of by position. In the above example, the only way someone would know that the 200 in the last call to `cap` specified the max is by its position. This can lead to hard-to-read function invocations for functions with lots of optional arguments. You can use keyword-style invocation to improve readability. The following code is equivalent to the last line above, using 200 for the `max` and the default for the `min`.

```
print cap(150, max=200)
```

Because we used a keyword to specify that 200 was the "max", we were able to omit the min argument altogether, using its default.

Note that not all functions in the standard library and the Ignition library can be called with keyword invocation. Functions that accept keyword invocation, like system.tag.queryTagHistory, will say so in their documentation.

Functions are Objects

Perhaps one of the most foreign concepts for new Python users is that in Python, functions are first-class objects. This means that functions can be passed around to other functions (this concept is similar to the idea of *function pointers* in C or C++).

Lets go back to the `isOdd` example above. Suppose we wanted a more general way to filter a list. Maybe sometimes we want the odd entries, while other times we want even ones, or entries less than 3, etc. We can define a function called `extract` that takes a list and *another function*, and returns only entries that "pass" through the other function.

```
def isOdd(num):
   return num % 2 == 1

def isEven(num):
   return num % 2 == 0

def isLessThan(num, max=3):
   return num < max

def extract(filterFunction, list):
```

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```
   newList = []
   for entry in list:
      if filterFunction(entry):
         newList.append(entry)
   return newList

# prints out [0, 2, 4, 6, 8]
# notice that isEven as not _invoked_, but passed to the filter function
print extract(isEven, range(10))
```

Now, it just so happens that Python has a built-in function that does exactly what our `extract` function does - its called `filter`.

We would also be remiss at this point if we didn't mention another language feature called *list comprehensions*. This is a great little bit of syntax that helps make new lists out of other lists. Instead of using our filter function, we could have simply done this:

```
def isEven(num):
   return num % 2 == 0

print [x for x in range(10) if isEven(x)]
```

If that looks cool to you - read more about list comprehensions at http://docs.python.org/tutorial/datastructures.html#list-comprehensions

In Ignition, you'll most commonly see functions used as objects when using the system.util.invokelater function. This function takes a function and executes it after all pending event handling has finished processing.

6.2.2.5 Scope and Import

The concept of *scope* is very important in all programming, and Python is no exception. Scope defines what names are directly accessible without any qualifiers. Another way to put this is that the scope determines what variables are defined. When you define a new function, that function gets its own scope. The statements within the function don't operate in the scope of the enclosing code. An example should make this clear:

```
x = 5
print x
def fun():
   x = 3 # this 'x' is not the same as the outer 'x'
   print x

fun()
print x
```

This code will print:

```
5
3
5
```

The assignment `x = 3` within the function did not affect the `x` defined outside the function's scope. Furthermore, if you tried to access `x` within the function `fun` without the `x = 3` line, you would receive a `NameError`, because `x` would not be defined.

Global Scope

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Besides your immediate scope, there is also the global scope. By declaring a name preceded with the keyword `global`, your variable will be resolved using the global scope, which is shared by all scripts.

```
global x
# will print whatever value some other script
# assigned to x in the global namespace
print x
```

Using the `import` keyword

You can import the namespaces defined in other scopes into your scope with the `import` keyword. Most commonly, you'll import from global library sources, like `system` (the Ignition standard libraries), `app` (your project's global script modules), `java` (importing from the Java standard library), and the various python standard libraries. When you're writing component event handlers, system and app are imported for you automatically. However, if you create a new scope by defining a function, you'll need to import those libraries manually.

The import keyword can be used in a variety of forms:

```
import X
from X import *
from X import Y
```

For example, suppose you wanted to use the java.util.Calendar class for some date manipulations. You could import this in a number of different ways. These examples are equivalent, printing out a date 8 hours before the current date.

```
import java
cal = java.util.Calendar.getInstance()
cal.add(java.util.Calendar.HOUR, -8)
print cal.getTime()
```

```
from java.util import Calendar
cal = Calendar.getInstance()
cal.add(Calendar.HOUR, -8)
print cal.getTime()
```

6.2.2.6 Sequences and Dictionaries

Python offers a variety of *sequence* types. We've already seen one - the List. There are other kinds of sequences, most notably *tuples* and *strings*. There is also the *dictionary* type, which contains a list of key-value pairs.

Lists

Lists are a very handy kind of sequence. They can hold any number of items, can be resized on the fly. After creating a list using the square bracket notation, there are a number of functions that you can call on the list. Some common list functions are listed here. Visit http://docs.python.org/tutorial/datastructures.html#more-on-lists for a complete list.

`append(x)` - takes a single argument, which will be appended to the end of the list.
`insert(i,x)` - inserts an item x at index i
`remove(x)` - will remove the given item from the list.
`index(x)` - returns the index of the value x. Throws an error if the list doesn't contain the item. Use

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the `in` operator to check if an item is contained in a sequence.
`sort()` - sorts the items in the list.

```
myList = ['a', 'b', 'c', 'd']
print myList # --> [a, b, c, d]

myList.append("Q")
print myList # --> [a, b, c, d, Q]

myList.insert(1, "Z")
print myList # --> [a, Z, b, c, d, Q]

myList.remove("c")
print myList # --> [a, Z, b, d, Q]

print myList[2] # --> b
print myLIst.index("b") # --> 2

if 'Z' in myList:
   print 'Z is in the list'

if 'c' not in myList:
   print 'c was removed from the list'
```

Tuples

A tuple is similar to a list, but you use parenthesis instead of square brackets to define one. The major difference between a tuple and a list is that tuple's are *immutable*. That is, once created, they cannot be altered. Tuples are very useful for passing multiple things to and from functions. For example, you could pass a point to a function using a tuple like so:

```
def printPoint(point):
   print "x = ", point[0]
   print "y = ", point[1]

printPoint((28,89))
```

This can also be handy for returning multiple values from a function. For example, if you had a mouse event, you could write a function that found the component's center point, and return that point as a tuple. You could then use *unpacking assignment* to extract the values into separate values.

```
def findCenter(event):
   w = event.source.width
   h = event.source.height
   return (w/2, h/2)

# point will be a tuple
point = findCenter(event)

# x and y will be numbers, using unpacking assignment
x,y = findCenter(event)
```

Dictionaries

A dictionary is a very useful type that holds a set of key-value pairs. You may have used these in other languages and know them as hashmaps, maps, associative memories or associative arrays. Dictionaries are not ordered sequences - you reference any item via its *key value*. The keys can be

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numbers, strings, or tuples of these types. Any given key may only appear once in a dictionary. Trying to set another value for that key will overwrite any previous value for that key.

Dictionaries are created using braces ({}). Key-value pairs are separated by commas, and the keys are separated from the values with a colon. You can use the .keys() function to have a set of the keys. For example:

```
myDict = {'Bob': 89.9, 'Joe': 188.72, 'Sally': 21.44}

print myDict['Bob'] # --> 89.9

myDict['Amir']=45.89 # Adds a key for 'Amir'

names = myDict.keys()
names.sort()
print names # --> ['Amir', 'Bob', 'Joe', 'Sally']
```

You can loop through dictionaries using a for loop. You can use the `keys()` to loop through the dictionary, and then use the key values to look up the value. For example:

```
for name in myDict.keys():
   print name, myDict[name]
```

6.2.2.7 Exception Handling

Exception handling is a language feature of many high-level languages that allows you to "catch" a runtime error and deal with it as you see fit. On the flip side, it allows you to "raise" or "throw" an error in your code, which will break out of whatever code is currently executing and jump to the nearest enclosing catch block that knows how to handle your error.

For example, dividing by zero raises a ZeroDivisionError. You can catch this error using a `try... except` block, like this:

```
try:
   result = 8 / 0
   print "this will never get called"
except ZeroDivisionError:
   print "oops - can't divide by zero"
```

You don't have to specify a particular type of error to catch - you can use the except keyword by itself to catch any kind of exception. You can also assign the details of the exception to a tuple of variables, which you can use in your error reporting. You can also have multiple except blocks for one try block, each that handle different kinds of exceptions. This example shows these variations:

```
def someDangerousFunction():
   raise IOError(42,"oh no")
try:
   someDangerousFunction()
except IOError, (errno, description):
   print "An I/O error occurred: "+description
except:
   print "An unexpected error occurred"
```

You can learn more about exceptions at http://www.python.org/doc/2.1/tut/node10.html.

6.2.2.8 Learn More

Online Tutorials

Since Python is such a popular and well-regarded language, there are many high-quality tutorials

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available on the web. The official python tutorial, written by the inventor of Python himself, Guido van Rossum, is very good.
http://www.python.org/doc/2.1/tut/tut.html

The Non-Programmers Tutorial For Python by Josh Cogliati is also very good for those with no previous programming experience.
http://www.oopweb.com/Python/Documents/easytut/VolumeFrames.html

You can go and download a printable Python "cheat sheet" from the Added Bytes website, available here:
http://www.addedbytes.com/cheat-sheets/python-cheat-sheet/

Recommended Books

Sometimes a good reference book is invaluable. The following books have gotten good reviews from us and our customers:

Learning Python (O'Reilly, 2007)
Python Pocket Reference (O'Reilly, 2005)
Core Python Programming (Prentice Hall, 2006)
Python Power (Course Technology, 2007)

Using Java

This book would be useful for anyone who finds themselves accessing the Java standard library frequently from Python:
Python Programming with the Java(TM) Class Libraries (Addison-Wesley, 2002)

You can also find the excellent API documentation for the Java standard libraries from Sun here:
http://java.sun.com/j2se/1.5.0/docs/api/index.html

Online Forum

Our online forum at http://www.inductiveautomation.com/forum is a great place to go for scripting help. Not only do we, the Inductive Automation staff, monitor it actively, but we have a thriving user community who can help you with any scripting questions.

6.2.3 Python in Ignition

6.2.3.1 Working with Different Datatypes

You'll encounter lots of different datatypes when scripting in Python. This guide should help you through the snags of working with some of the more complex types.

Numbers

Working with numbers is very easy in Python, and requires no special considerations. You can use the built-in function `int()` to attempt to coerce values to integers, and `float()` to coerce values to floating-point values. Both will throw `ValueError` if the coercion fails.

If you are new to programming, the following might throw you off. Python, like nearly all programming languages, uses *integer division* when dividing two integers. This means that `1/2` will result in `0`. This is because both 1 and 2 are integers, so the result of the division must be an integer. The result of 0.5 gets truncated to 0. If either operand is a float, the result will be a float, so `1 / 2.0` will result in `0.5`.

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Strings

Strings are used frequently in scripting. Strings can be defined using double quotes *or* single quotes. Learning how to use String Formatting is a very useful technique. You can user the built-in function `str()` to coerce values into strings.

Colors

Working with colors in Python is remarkably easy. You can simply use any tuple of 3 or 4 integers to represent a color in RGB or RGBA. For example, to set a label's text color to red, you can simple do something like this:

```
label = event.source
label.foreground = (255,0,0)
```

Dates

Dates are one of the trickier datatypes to deal with in scripting. It turns out that it is easier to deal with dates using the Java classes `java.util.Date` and `java.util.Calendar` than it is to use Python's `time` module.

Creating Dates

To create an arbitrary date, you can use the `java.util.Calendar` class. It has various functions to alter the calendar fields, like Calendar.HOUR, Calendar.MONTH, etc. After you're done manipulating the Calendar, you can use its `getTime()` function to retrieve the Date represented by the calendar. It also has a handy set() function that takes the common parameters of a Date. The one **major gotcha** here is that January is month *zero*, not month one. For example:

```
from java.util import Calendar
cal = Calendar.getInstance()

# set year, month, day, hour, minute, second in one call
# This sets it to Feb 25th, 1:05:00 PM, 2010
cal.set(2010, 1, 25, 13, 5, 0)
myDate = cal.getTime()
```

Date Arithmetic

Often you'll have a Date object from a component like the Popup Calendar and want to alter it programmatically. Say, subtracting 8 hours from it, or something like that. The `java.util.Calendar` class is used for this as well. Following the example above, this code would subtract 8 hours from the variable `myDate`.

```
from java.util import Calendar
cal = Calendar.getInstance()

cal.setTime(myDate)
cal.add(Calendar.HOUR, -8)
myNewDate = cal.getTime()
```

Date Formatting

To format a date as a String, you can use the system function system.db.dateFormat. This function uses a *format string* to give it a hint as to how you want your date formatted. The format string is full of various placeholders that will display different parts of the date. These are case-sensitive! The most common placeholders are:

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y	Year
M	Month
d	Day
E	Day of Week
a	am/pm marker
H	Hour of day (0-23)
h	Hour in am/pm (1-12)
m	Minute
s	Second
S	Millisecond
z	Time zone

These placeholders can be repeated for a different effect. For example, `M` will give you 1-12, `MM` will give you 01-12, `MMM` will give you Jan-Dec, `MMMM` will give you January-December. Here are some examples:

```
from java.util import Date

now = Date() # creates a new date, for right now

# Common format for databases
print system.db.dateFormat(now, "yyyy-MM-dd H:mm:ss")

# Nice human-readable format for just the date
print system.db.dateFormat(now, "MMM d, yyyy")

# Formating just the time in am/pm style
print system.db.dateFormat("h:mm a")
```

Datasets

It is very common to deal with datasets in scripting, as datasets power many of the interesting features in Ignition, like charts and tables. The `system.dataset` library provides various functions for manipulating and creating datasets.

The main confusion when dealing with datasets is the difference between the DataSet object and the PyDataSet object. DataSet is the kind of object that Ignition uses internally to represents datasets. When you get the `data` property out of a Table, for example, you'll get a DataSet. The PyDataSet is a *wrapper* type that you can use to make DataSets more accessible in Python. You can convert between the two with system.dataset.toPyDataSet and system.dataset.toDataSet.

Accessing data in a DataSet

DataSets have various properties and functions that you can access through Python.

`rowCount` - returns the number of rows in the dataset
`columnCount` - returns the number of columns in the dataset
`getColumnName(index)` - returns the name of the column at the given index
`getValueAt(row, column)` - returns the value from the dataset at the given location. column can be either an integer or a column name, which is treated case-insensitive.

For example, you could iterate through every item in a DataSet in scripting like this:

```
# Pull the dataset property off a Table component
data = event.source.getComponent("Table").data

for row in range(data.rowCount):
   for col in range(data.columnCount):
      print data.getValueAt(row, col)
```

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or you could find specific values from each row in a DataSet like this:

```
# Pull the dataset property off a Table component
data = event.source.getComponent("Table").data

for row in range(data.rowCount):
   temp = data.getValueAt(row, "Temperature")
   speed = data.getValueAt(row, "Speed")
   print temp, speed
```

Accessing data in a PyDataSet

You can convert a dataset to a PyDataSet, which lets you use it more like a Python sequence. You don't have to do this, its purely a convenience. A PyDataSet is like a list of dictionaries, and so it can use the normal for loop syntax. These examples are equivalent to the examples above.

Iterating through a PyDataSet

```
# Pull the dataset property off a Table component
data = event.source.getComponent("Table").data

# Convert to a PyDataSet
pds = system.dataset.toPyDataSet(data)

for row in pds:
   for value in row:
      print value
```

Finding specific values in a PyDataSet

```
# Pull the dataset property off a Table component
data = event.source.getComponent("Table").data

# Convert to a PyDataSet
pds = system.dataset.toPyDataSet(data)

for row in pds:
   temp = row["Temperature"]
   speed = row["Speed"]
   print temp, speed
```

Accessing specific elements in a PyDataSet

```
# Pull the dataset property off a Table component
data = event.source.getComponent("Table").data

# Convert to PyDataSet
pds = system.dataset.toPyDataSet(data)

# Grab the first item of the first row
value = pds[0][0]
print value
```

Altering Datasets

Technically, you cannot alter a dataset. Datasets are *immutable*, meaning they cannot change. You can, however, create *new* datasets. So to alter a dataset, you really create a new one and then replace the old one with the new one. Because this is so common, there are special functions under system.dataset that are designed for this. You can use the following functions to create datasets that are altered version of existing datasets:

- system.dataset.addRow
- system.dataset.deleteRow

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system.dataset.setValue
system.dataset.updateRow

The important thing to realize about all of these datasets is that, again, they do not actually alter the input dataset. They return a new dataset. You need to actually use that returned dataset to do anything useful. For example, this code would set the "Quantity" column in the selected row of a table to 15.8:

```
table = event.source.parent.getComponent("Table")
selRow = table.selectedRow
if selRow != -1:
   # Create a new dataset
   newData = system.dataset.setValue(table.data, selRow, "Quantity", 15.8)

   # Replace the Table's data property with the new dataset
   table.data = newData
```

Creating Datasets
Sometimes you'll want to create a new dataset from scratch. This can be easily done with the system.dataset.toDataSet
function. All it needs are the column headers and a list of the rows in the dataset. Each row must have the same number of elements as the header list. For example, this code would create a dataset that contained some information about US cities:

```
headers = ["City", "Population", "Timezone", "GMTOffset"]
data = []

data.append(["New York", 8363710, "EST", -5])
data.append(["Los Angeles", 3833995, "PST", -8])
data.append(["Chicago", 2853114, "CST", -6])
data.append(["Houston", 2242193, "CST", -6])
data.append(["Phoenix", 1567924, "MST", -7])

cities = system.dataset.toDataSet(headers, data)
```

6.2.3.2 Working with Components

When you're writing component event handlers, you'll do a lot of work with components. You'll need to reference various components on the window or on other windows, you'll need to reference and set properties of the component, you may even want to move components around on the screen.

Finding Components

When you have an `event` object, that object becomes your window into the entire component hierarchy. `event.source` references the component that fired whatever event you're responding to. `event.source.parent` references the container that component is in. `event.source.parent.getComponent("Name")` finds a sibling component with a certain name. The manual page for the event object covers this topic in more detail.

Accessing Component Properties

Once you have a reference to a component, you can treat it just like any Python object. You can call functions on it, and you can reference its properties, both standard and dynamic, with the "." accessor. For example, you could put this in a button next to the table, which would tell the user which row was selected, then clear the selection, and then print the table.

```
table = event.source.parent.getComponent("Table")
```

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```
# Referencing properties of a component
row = table.selectedRow
system.gui.messageBox("The selected row is : %d" % row)

# Setting properties of a component.
table.selectedRow = -1

# Calling functions on components
table.print()
```

Finding Components on Other Windows

Sometimes you may want to reference components on other windows. Or maybe you don't have an 'event' object because you're writing a project event script. In this case, you'll need to look up the containing window first. You can do this with the system.gui.getWindow function. This function will throw a ValueError if the given window isn't open, so you should make sure your code handles that gracefully. Once you have a Window, you can use its `rootContainer` property to get into the standard component hierarchy. This code will look up the HeaderLabel on a window named "Overview" and set its text and foreground color.

```
try:
   window = system.gui.getWindow("Overview")
   label = window.rootContainer.getComponent("HeaderLabel")
   label.text = "Notice Me!"
   label.foreground = (255,0,0)
except ValueError:
   # ignore error with a pass keyword
   pass
```

Common Component Functions

There are a number of functions that are common to all components in Ignition.

`requestFocusInWindow()` - requests that the component be given input focus. See also: Focus Events.
`setPropertyValue(name, value)` - sets the value of a component's custom property.
`getPropertyValue(name)` - gets the value of a custom property.

Moving/Resizing Components and Windows

You can use scripting to move and resize a component at runtime. The functions system.gui.moveComponent, system.gui.reshapeComponent and system.gui.resizeComponent are used for this. They simply take a component, and a new size, location, or both. Locations are always measured in pixels from the upper left point of the component's parent container.

Note that if you're moving a component that is set to relative layout, your coordinates will act as if they were coordinates to the sizes of the relevant containers *last time they were saved in the Designer*, not the current real coordinates of the runtime. This is very helpful for creating animations. In effect what this means is that the coordinates fed into these functions "respect" the relative layout system automatically.

You can move and resize windows as well. If you have a reference to a window, you can set its size and location directly. For example, if you wanted to move the floating window Popup3 to certain location, you could do so like this:

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```
try:
   window = system.gui.getWindow("Popup3")
   window.setSize(250,600)
   window.setLocation(0,0)
except ValueError:
   # ignore error with a pass keyword
   pass
```

See also:
The 'event' object

6.2.3.3 Global Script Modules

Your project can have a set of global script modules that any other script can reference. These modules all reside under the `app` namespace. These modules are available in bath Gateway and Client scope scripts. This is a great way to extract common logic into a central place - a core tenet of a well designed code.

To use your global script module, you'll need to have `app` imported into your current scope. Event handler scripts get this automatically, but user defined functions and other scripts will have to use `import app` to use global script modules.

See also:
Script Modules

6.2.3.4 Gateway vs Client Scripts

Your project can execute scripts under two different scopes: *Gateway* and *Client*.

Gateway scripts execute on the Ignition Gateway, which means that they will always execute in exactly one place.

Client scripts execute on *each* running Client. Because Clients are full-fledged applications, this means that the scripts are running on the computer running the client, not on the Gateway's host server computer. This means that they don't have access to the Gateway's filesystem, etc. It also means that if no clients are launched, the scripts will not be executing.

See also:
Project Event Scripts

6.2.3.5 Timer, Keystroke, and Tag Change Scripts

You can have scripts run for all sorts of global events. These are called project event scripts. You can have a script run every time a tag changes value, a key is pressed etc.

See also:
Project Event Scripts

6.2.3.6 Python Standard Library

You can use much of the Python standard library in Ignition.

Learn more about the python standard library at http://www.python.org/doc/2.5/lib/lib.html

Note that the "normal" implementation of Python that programmers may be used to is actually called

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"CPython" that is - the Python engine is implemented in C. In Ignition we use Jython - Python implemented in Java. The language itself is identical, but there are some important differences. One important difference is that in Jython you can access all of the Java standard library. Another important difference is that the standard library is different than what you'd find in the normal python standard library. You can read more about these differences here: http://www.jython.org/docs/library/indexprogress.html

6.2.3.7 Component Event Handlers

Using scripts to handle component events is one of the most common places to use scripting in Ignition. When an event occurs for a component, like a mouse click or a key press, you can have your script (the *event handler*) be called.

When your event handler is executed, it already has three names in scope:
`event` - the event object
`system` - the root of the Ignition Scripting API
`app` - the root of your project's script modules

See also:
Event Handlers Overview

6.2.3.8 Component Extension Functions

Some components may expose functions that can be extended using scripting. These functions will be called by the component itself when appropriate. For example, the Table component exposes an extension function called `getBackgroundColorAt()`. By implementing this function, one can control the background color of each cell of the table component using scripting.

Extension functions allow you in a loose sense to create a custom "*sub-class*" of the base component type, from an object-oriented point of view. Your sub-class can then override/implement parts of the functionality of the component itself, in python. This is a very powerful, if somewhat advanced, way of configuring the component. Each component extension function comes with its own documentation built-into the function's default implementation using a standard Python "doc-string". You will find that you are unable to edit the function's signature or docstring. Changing the method's signature (arguments or function name) would prevent the component from calling it correctly. Changing the docstring could be misleading or confusing as you'd lose the documentation for how your implementation of the function should work.

Following Python object-oriented methodology, you'll notice that each extension function's first argument is called "`self`". That is because these are methods *belong* to the component's class itself. That is, they are *instance methods.* The value of `self` will always be the component itself. Notice that this is different than component event handler scripts. In those scripts, you are given an `event` object in your scope. The component that fired the event will be under `event.source`. When you write an extension function, there is no `event` object. The component is given to you as the `self` object instead.

6.2.3.9 Accessing Java

When programming Python in Ignition, your code executes in the Jython implementation of Python. (See About Scripting - Python or Jython?). While this doesn't have any great effect on the Python language itself, one of the great side benefits is that your Python code can seamlessly interact with Java code, *as if it were Python code*. This means that your Python code has access to the entire Java standard library, which is saying a lot.

To use Java classes, you simple import them as if they were Python modules. For example, the

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following code will print out all of the files in the user's home directory. This code uses the Java classes `java.lang.System` and `java.io.File` to look up the user's home directory and to list the files. Notice that we can even use the Python-style `for` loop to iterate over a Java sequence.

```
from java.lang import System
from java.io import File

homePath = System.getProperty("user.home")
homeDir = File(homePath)

for filename in homeDir.list():
   print filename
```

You can find the reference documentation for the Java standard class libraray (a.k.a. the "*JavaDocs*") here: http://docs.oracle.com/javase/6/docs/api/

Subclassing Java

You can even create Python classes that implement Java interfaces. If this is greek to you - don't worry, it isn't crucial. You'd need some understanding of Java and object-oriented programming concepts, which are outside the scope of this manual.

To create a Python class that implements a Java interface, you simply use the interface as a superclass for your Python class. For example, we could augment the example above to use the overload `java.io.File.list(FilenameFilter)`. To do this, we'll need to create a `FilenameFilter`, which is an interface in Java that defines a single function:

```
boolean accept(File dir, String name)
```

To implement this interface, we create a Python class that has java.io.FilenameFilter as its superclass, and implements that Java-style function in a Python-esque way.

```
from java.lang import System
from java.io import *

class ExtensionFilter(FilenameFilter):
   def __init__(self, extension=".txt"):
      self.extension=extension.lower()

   def accept(self, directory, name):
      # make sure that the filename ends in the right extension
      return name.lower().endswith(self.extension)


homePath = System.getProperty("user.home")
homeDir = File(homePath)

# prints out all .txt files
for filename in homeDir.list(ExtensionFilter()):
   print filename

# prints out all .pdf files
for filename in homeDir.list(ExtensionFilter(".pdf")):
   print filename
```

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6.2.4 Web Services & SUDS

6.2.4.1 Overview & Simple Arguments

Web Services Overview

Web services are software solutions that allow for interacting with machines residing on a network. In short, web services are nothing more than web pages for machines. They provide a standard way for a third party to request and receive data from a piece of hardware on the network without having to know anything about how that machine works. Other programs interact with the service through an interface defined by a WSDL (Web Services Description Language) file. This WSDL describes how to talk with the device and what should be expected back in response. Messages to and from the web service are formatted XML and while you need very little knowledge of XML to use the SUDS library, many times a web service will return a formatted XML string that you will have to parse through manually in order to make the data presentable.

The SUDS Library

The SUDS library is soap-based web services client developed for python. It is extremely simple to use and practically eliminates the need for the user to understand or even view the WSDL of a web service. The SUDS library interprets the WSDL file for you and through couple simple function calls allows you to get a list of the available methods provided to you by the web service. You can then invoke these methods in Ignition through event scripting to send and receive data in your projects. You will have to familiarize yourself with the SUDS library in order to make use of it. The SUDS documentation and the PyDocs are a good place to start.

A Simple Example

If you read through the SUDS documentation you'll see that the Client object is the primary interface for most users. It is extremely simple using this object and a few print statements to view a list of available methods provided by the web service you are connecting to. This example will illustrate how to make an initial connect to a web service, print out the list of available methods, and then call one of these methods and display the resulting value in a label on an Ignition window at the push of a button. The below example uses a public web service and is available for anyone to test against.

First, we can use the script playground to test out some scripting calls and see the output. The below example shows how to get a reference to a client object. By printing this client object to the console we get an output of all the available methods, types and other information about the web service as defined in the WSDL file.

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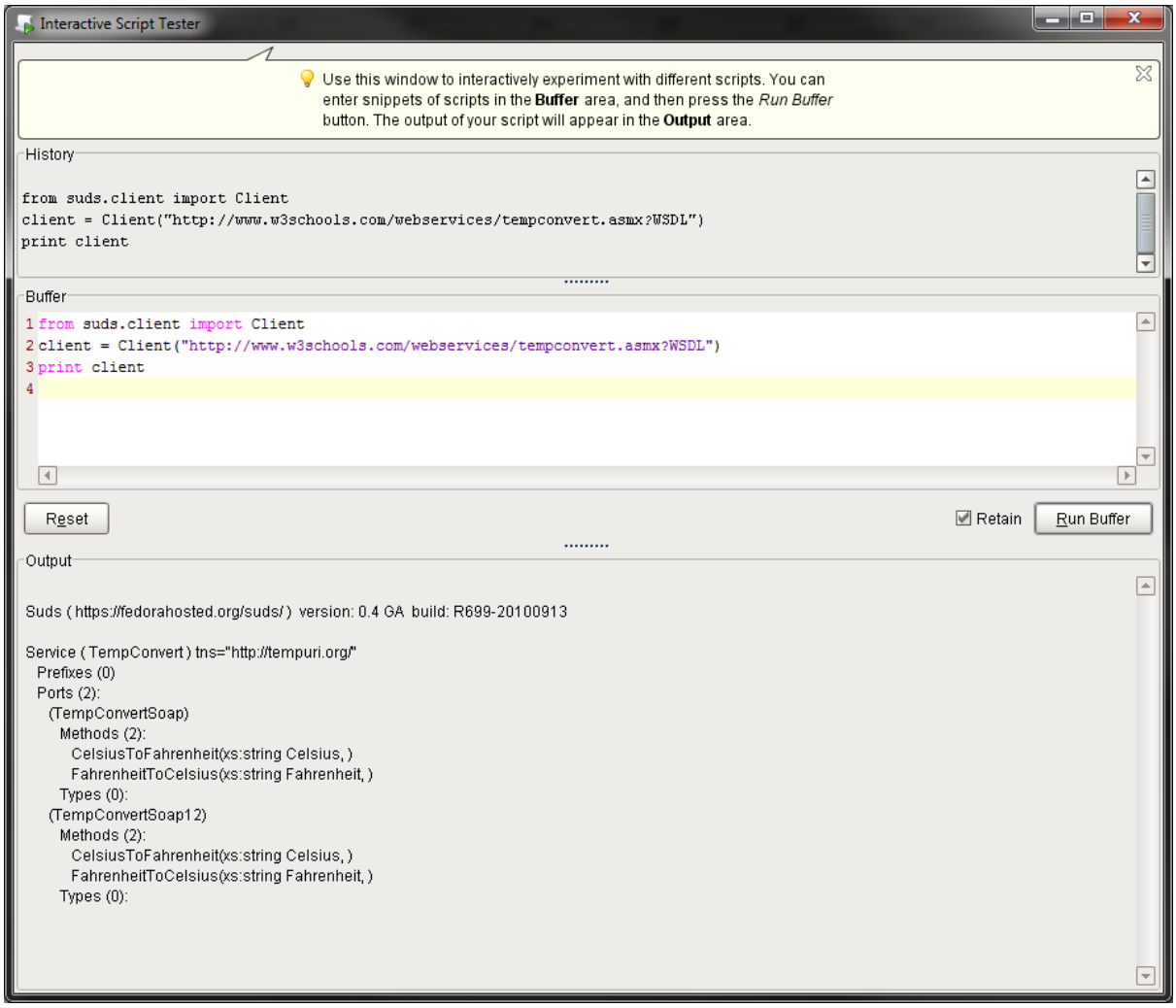

This WSDL defines two functions: CelsiusToFahrenheit(string Celsius) and FahrenheitToCelsius(string Fahrenheit). These are the functions that this web service makes available to you. Don't worry about the fact that the methods are listed twice. This is just because the WSDL has two definitions of the functions that are formatted for different SOAP version standards. To call these functions in Ignition scripting you have to make use of the "service" member of the client object.

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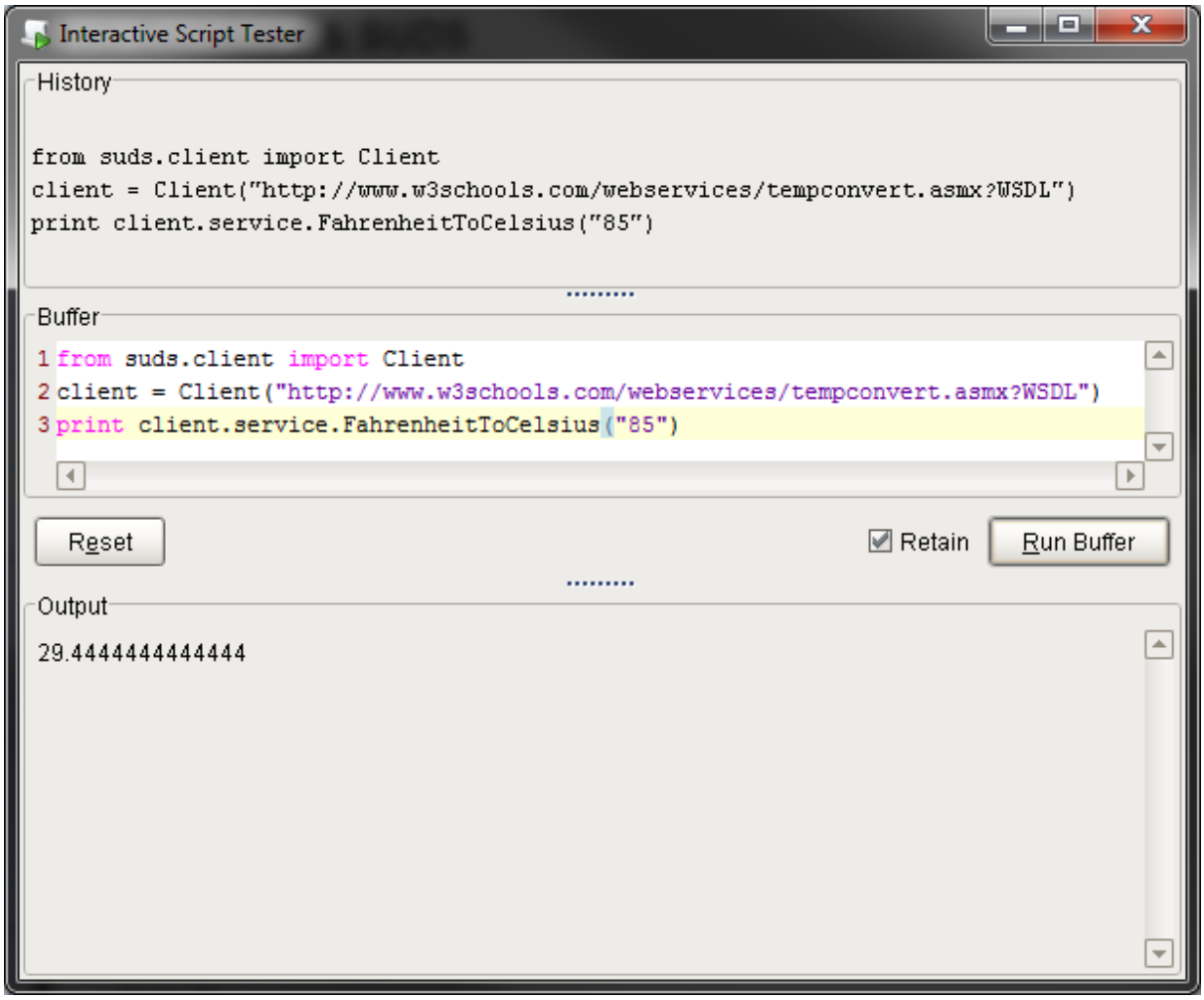

To make a simple conversion window in an Ignition project you can add two buttons, a numeric textbox, and a lable to a window. Then on the button to be used to calculate a Fahrenheit to Celsius calculation you would place something like the following:

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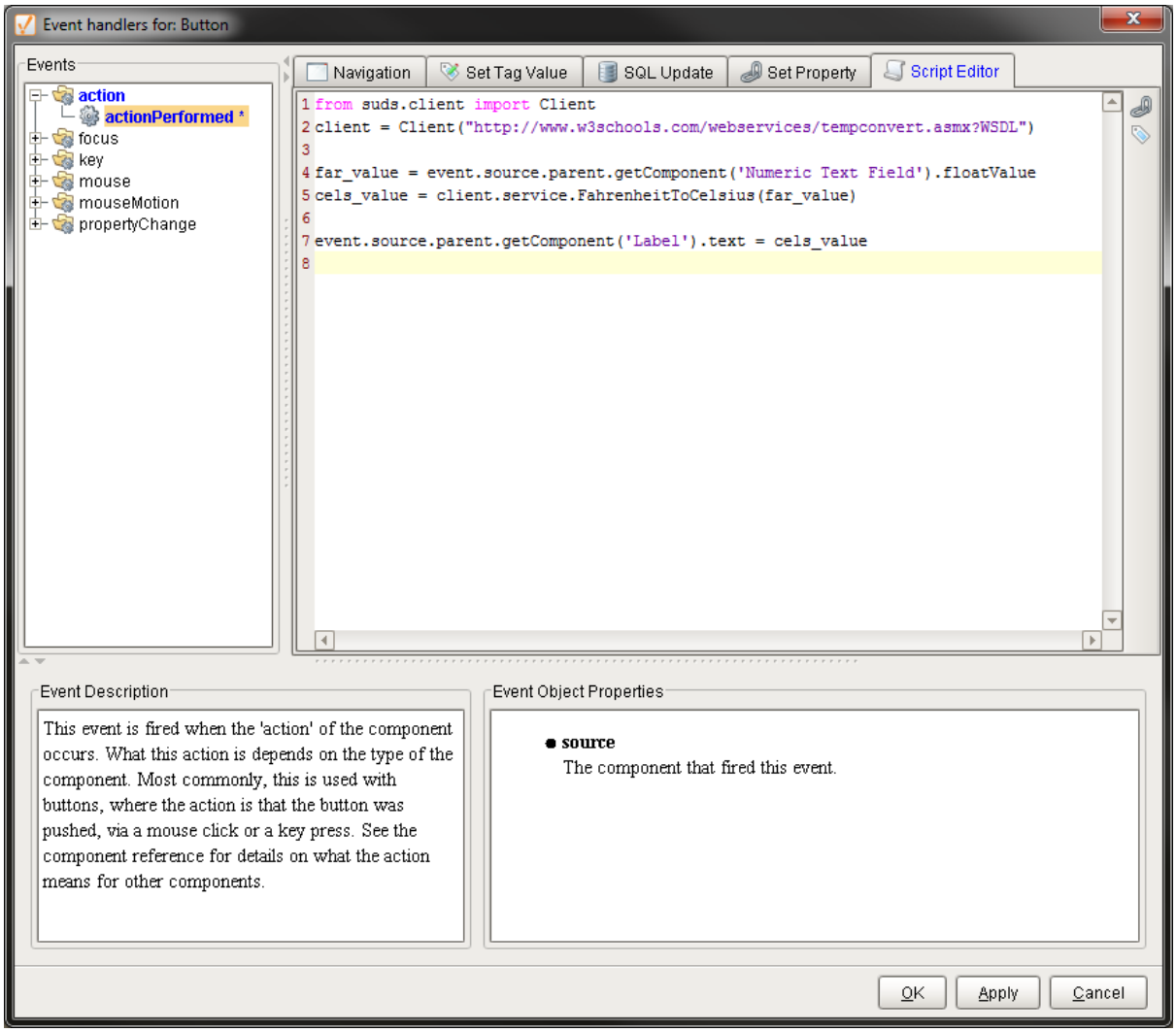
Event handlers for: Button
Events
action
actionPerformed *
focus
key
mouse
mouseMotion
propertyChange
Navigation
Set Tag Value
SQL Update
Set Property
Script Editor
1 from suds.client import Client
2 client = Client("http://www.w3schools.com/webservices/tempconvert.asmx?WSDL")
3
4 far_value = event.source.parent.getComponent('Numeric Text Field').floatValue
5 cels_value = client.service.FahrenheitToCelsius(far_value)
6
7 event.source.parent.getComponent('Label').text = cels_value
8
Event Description
This event is fired when the 'action' of the component occurs. What this action is depends on the type of the component. Most commonly, this is used with buttons, where the action is that the button was pushed, via a mouse click or a key press. See the component reference for details on what the action means for other components.
Event Object Properties
source
The component that fired this event.
OK
Apply
Cancel

Then on the second button do the opposite.

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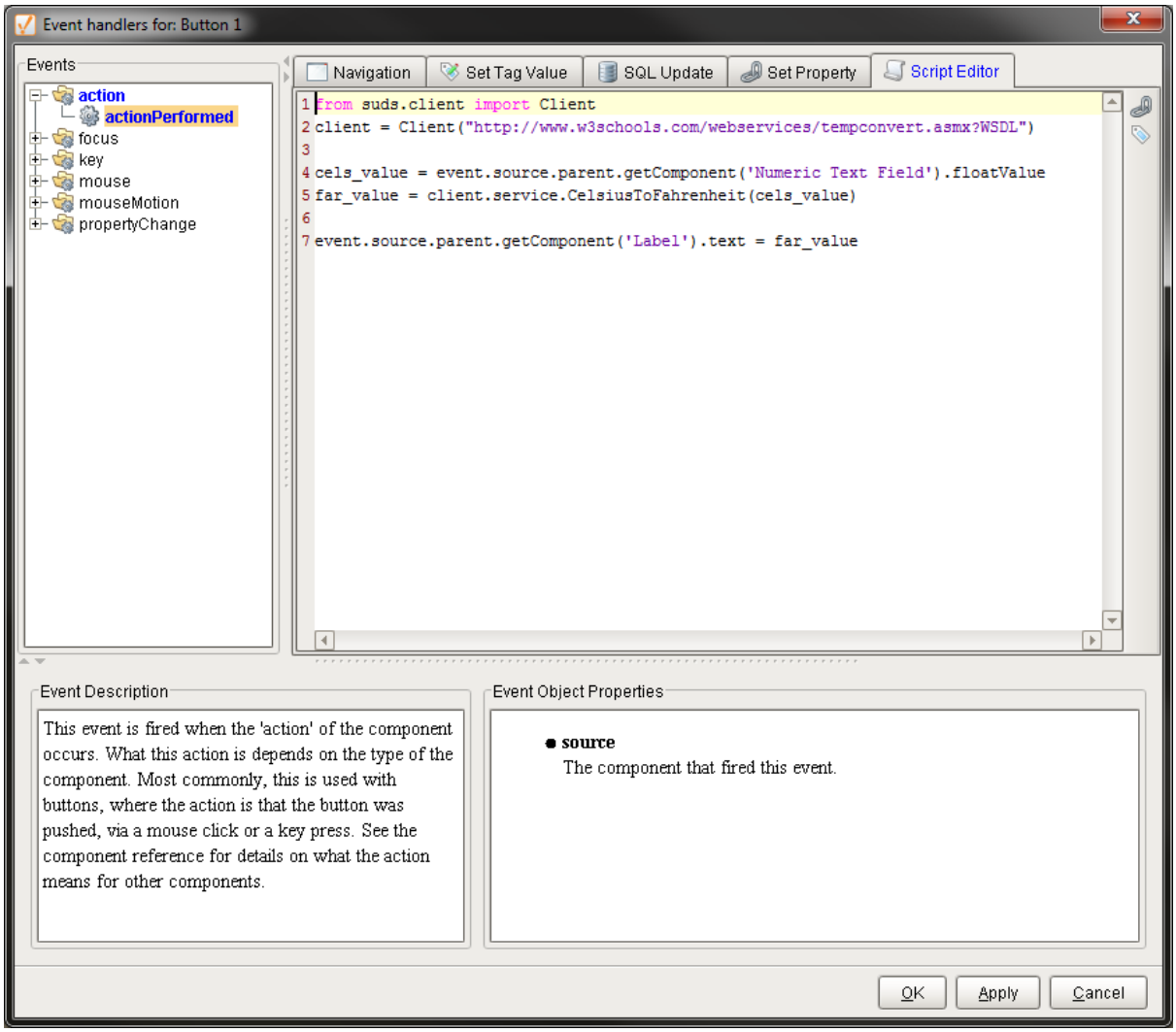
Event handlers for: Button 1
Events
action
actionPerformed
focus
key
mouse
mouseMotion
propertyChange
Navigation
Set Tag Value
SQL Update
Set Property
Script Editor
1 from suds.client import Client
2 client = Client("http://www.w3schools.com/webservices/tempconvert.asmx?WSDL")
3
4 cels_value = event.source.parent.getComponent('Numeric Text Field').floatValue
5 far_value = client.service.CelsiusToFahrenheit(cels_value)
6
7 event.source.parent.getComponent('Label').text = far_value
Event Description
This event is fired when the 'action' of the component occurs. What this action is depends on the type of the component. Most commonly, this is used with buttons, where the action is that the button was pushed, via a mouse click or a key press. See the component reference for details on what the action means for other components.
Event Object Properties
source
The component that fired this event.
OK
Apply
Cancel

With your scripts in place your window should now function as a simple temperature conversion tool!

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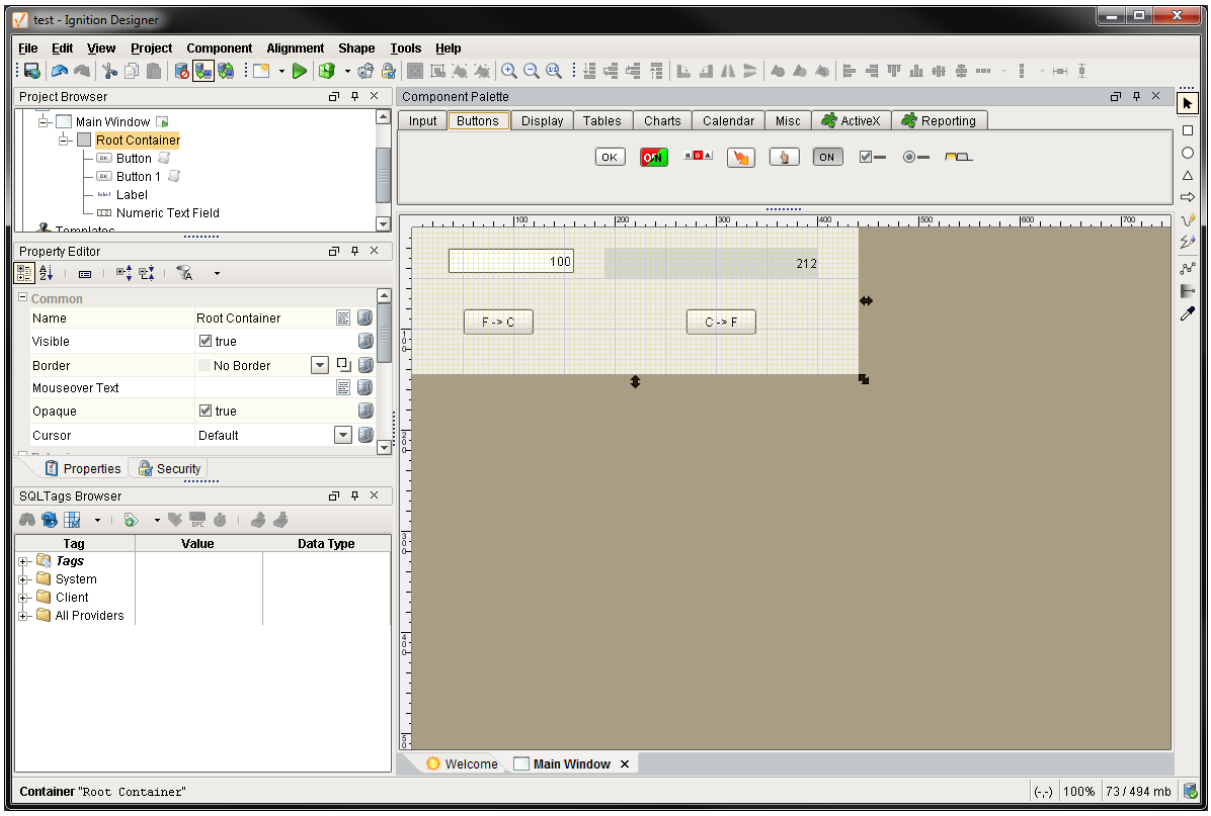

This example is extremely simple and rather straight forward. The main steps to remember when attempting to use the SUDS library in scripting are as follows:

1. Import the SUDS Client object
```
from suds.client import Client
```
2. Instantiate a new Client object
```
client = Client("url_to_your_wsdl")
```
3. Call the desired method using the service instance variable
```
client.service.MyMethod(myArgument)
```

6.2.4.2 Complex Arguments

In the overview example the methods provided by the web service were very simple and took simple argument types. Sometimes however the web service will describe complex types and allow you create instances of these types that can then be added to the system/machine that the web service is providing an interface for.

A simple, hypothetical example of this would be a system that stores contact information of clients and can be used as an address book of sorts by other systems on the network. It may provide not only a way to pull contact information for a certain individual out but also a way to insert new contacts. We'll keep the example simple and say that contacts have only a name and a phone number.

This example is completely hypothetical. It is intended to give insight into complex types. It does not make use of an an actual functional web service. A very similar example can be found in the SUDS documentation.

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Say we create and print the client object we associated with our web service in the following manner

```
from suds.client import Client
url = 'http://localhost:7575/webservices/hypothetical_webservice?wsdl'
client = Client(url)
print client
```

And the resulting output is the following:

```
Suds ( https://fedorahosted.org/suds/ )  version: 0.4 GA  build: R699-20100913

Service (hypothetical_webservice)
   Prefixes (0):
   Ports (1):
     (Soap)
       Methods:
         addContact(Contact contact, )
         getContactList(xs:string str, xs:int length, )
         getContactByName(Name name, )
   Types (3):
     Contact
     Name
     Phone
```

Here you can see that, while not too complicated the web service defines more than just methods that take simple type arguments and return the same. Under the Types section you can see there are three "complex" types. These are basically just objects like one creates in an object oriented programming language like java. The SUDS Client object has an instance variable called "factory" that allows you to create these complex types so you can use them to invoke methods defined by your web service that take complex arguments.

If we wanted to add a contact using the addContact() method we have to create a contact object first:

```
contact = client.factory.create('Contact')
print contact
```

The create function creates a new contact object that knows its own structure. We can view this structure by calling print on this new object and see that it prints the following:

```
(Contact)=
  {
    phone = []
    age = NONE
    name(Name) =
        {
            last = NONE
            first = NONE
        }
   }
```

By examining the Contact type object we can see its structure and know what we need to create in order to have a valid Contact to add to the address book. We could then do the following to supply the necessary information for the Contact object and then call our addContact function.

```
phone = client.factory.create('Phone')
phone.arecode = '916'
phone.number = '5557777'

name = client.factory.create('Name')
name.first = 'John'
name.last = 'Doe'

contact.name = name
```

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```
contact.phone.append(phone)

client.service.addContact(contact)
```

After execution a new contact will have been added via the web service. There is also a way to use python dictionaries to specify complex arguments that is detailed in the SUDS documentation.

Steps to remember when using complex types:

1. Create a new type object using the factory instance variable of the Client object
   ```
   my_type = client.factory.create('MyType')
   ```
2. If you don't know the structure of the newly created object then print it to the console
   ```
   print my_type
   ```

6.2.4.3 Parsing XML Results

It's quite easy deal with return values of method calls when they are simple none structured values like floats or integers. However it's not always the case that you will have simple single values returned from a method call. Many times web services will return values that have some sort of structure to them like a dataset. Since there is no way for the web service to know how this value should be represented in the language/environment that called the method it is common that the result will be returned in an XML formatted string. Dealing with these strings is not really part of the SUDS library but an example of XML string handling is included here for completeness. This example makes use of the xml.dom.minidom python module to parse the XML string and pull out the data.

Periodic Table Example - Using xml.dom.minidom XML parsing

One of the public web services that are available has a method for returning the elements in the periodic table in a structured string. This example will show you how you can take that string result, parse through it and then create an Ignition dataset that can be displayed in a table component. The xml.dom.minidom library provides the functionality for parsing XML strings and returning what is called an XML Document (in fact DOM stands for Document Object Model). This Document has functions that allow you access the elements within the document by specifying their respective XML tags. Most of this library is out of the scope of this document but if you have any questions about the functions being used they can be found here and here.

1. The call to the web service to get the list of elements
   ```
   from suds.client import Client
   from xml.dom.minidom import parseString
   client = Client("http://www.webservicex.net/periodictable.asmx?WSDL")
   elements = client.service.GetAtoms()
   ```
2. The elements variable will now contain a structured string of the following format. We take note of this format so we will know how to parse the string.
   ```
   <NewDataSet>
    <Table>
     <ElementName>Actinium</ElementName>
    </Table>
    ...
   </NewDataSet>
   ```
3. Now we can parse the string and create a list of the element data
   ```
   dom = parseString(xml_string)
   xmlTags = dom.getElementsByTagName('ElementName')
   xmlData = []
   for tag in xmlTags:
   ```

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```
    xmlData.append(tag.firstChild.data)
```

4. The xmlData list now contains all of the names of the elements from the periodic table. Now let's get separate lists for all of the atomic numbers, atomic weights, and element numbers in the same order as our element list

```
element_weights = []
element_numbers = []
element_symbols = []
for name in element_names:
    weight = parseString(client.service.GetAtomicWeight(name)).getElementsByTagName('AtomicWeig
    number = parseString(client.service.GetAtomicNumber(name)).getElementsByTagName('AtomicNumb
    symbol = parseString(client.service.GetElementSymbol(name)).getElementsByTagName('Symbol')[
    element_weights.append(weight)
    element_numbers.append(number)
    element_symbols.append(symbol)
```

5. With our four lists we can now go about building a dataset and then use the dataset to set the data property on a table

```
headers = ["Name", "Symbol", "Weight", "Number"]
i = 0
rows = []
for name in element_names:
    oneRow = [name,element_symbols[i],element_weights[i],element_numbers[i]]
    rows.append(oneRow)
    i += 1
data = system.dataset.toDataSet(headers, rows)
event.source.parent.getComponent('Table').data = data
```

6. Put all of that together and throw it on a button's actionPerformed event inside a window with a table on it and test away! It should be noted that this script will take a couple minutes to run since there is no function to get all of the weights, numbers or symbols in one method call. Be patient.

6.3 Expressions

6.3.1 Overview

The expression language is used to define dynamic values for component properties and expression tags. Expressions often involve one or more other values that are used to calculate a final value. Expressions don't *do* anything, other than return a value.

The classic example for an expression is to change a temperature that is stored in Celsius to Fahrenheit in order to display it. Suppose you had a tag, `Tank6/Temp` that was in Celsius. If you wanted to display that tag in Fahrenheit on a Label, you would use an Expression Binding on the label's *text* property using the following expression:

```
1.8 * {Tank6/Temp} + 32
```

Every time that the temperature tag changes, the expression will re-calculate the value and push it into the Label's text property. Now lets say that you wanted to append a "°F" to the end of the label so that the user knew the units of the temperature. You could simply use some string concatenation in your expression, like this:

```
(1.8 * {Tank6/Temp} + 32) + " °F"
```

Lets suppose that you wanted to give the user an option to display the value in Celsius or Fahrenheit, based on checking a checkbox. You could add a Check Box component to th screen called

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DisplayFahrenheit. Then you could use this expression to dynamically display either unit, based upon the user's selection:

```
if({Root Container.DisplayFahrenheit.selected},
    (1.8 * {Tank6/Temp} + 32) + " °F",
    {Tankf/Temp} +  " °C")
```

Where are Expressions Used?

Expressions are used in two major areas:
1. Expression Binding. The expression property binding is the most common area to use an expression. These expressions can reference tag values and property values in the same window.
2. Expression Tags. You can use an expression to dynamically calculate the value of a tag itself using a tag expression.
3. Expression Items. Expression items found in SQLBridge Transaction Groups. This uses the standard expression set with a few additions.

6.3.2 Syntax

As its name suggests, everything in the expression language is an "*expression*". This means that everything *returns a value*. `5` is an expression. So is `5+1`. So are `{MyTags/TankLevel}` and `{MyTags/TankLevel}+1`. Expressions can be combined in many powerful ways. Lets take a look at how expressions are written.

More formally, an expression is:
A Number
A Boolean
A String
A bound SQLTag
A bound property
A function call
A Dataset access
An equation involving any of these

Literal Values

Literal values are things like numbers, booleans, and strings that are represented directly in the language. In the expression language, numbers can by typed in directly as integers, floating point values, or using hexadecimal notation with a 0x prefix. Examples:

```
42
8.927
0xFFC2
```

Strings are represented by surrounding them with double or single quotes. You can use the backslash character to escape quotes that you want to be included in the string. Examples:

```
"This is a regular string"
'This one uses single quotes'
"This string uses \"escaping\" to include quotes inside the string"
```

Operators

You can use these arithmetic, logical, and bit-shifting operators to combine expressions.

-	Unary Minus	Negates a number.
!	Not	Logical opposite of a boolean

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^	Power	Raises a number to the power of another number. `a^b` is a^b
%	Modulus	Modulus or remainder of two numbers. `a%b` is the *remainder* of `a÷b`
*	Multiply	
/	Divide	
+	Add / Concatenate	If both operands are numbers, this will add them together. Otherwise treats arguments as strings and performs concatenation.
-	Subtraction	
&	Bitwise AND	
|	Bitwise OR	
xor	Bitwise XOR	
<<	Left Shift	A signed bitwise left shift
>>	Right Shift	A signed bitwise right shift
>	Greater Than	Logical greater-than test between two numbers. Returns a boolean.
<	Less Than	
>=	Greater or Equal	
<=	Less or Equal	
=	Equal	Tests for equality between two operands.
!=	Not Equal	Tests for equality, returning true when not equal
&&	Logical AND	Returns true when both operands are true. Anything non-zero is considered true.
||	Logical OR	Returns true when either operand is true. Anything non-zero is considered true.
like	Fuzzy string matching	Compares the left-hand value with the pattern on the right side. The pattern may consist of %,*, and ? wildcards.

Bound Values

Bound values are paths to other values enclosed in braces. These will appear red in the expression editor. When you are writing an expression for a Expression Binding, you can reference tag values and property values using the brace notation. When you are writing an expression for an Expression Tag, you can only reference other tag values. You can use the Insert Property ( ) and Insert Tag Value ( ) buttons to build these references for you.

Dataset Access

If you have an expression that returns a Dataset, you can pull a value out of the datatset using the dataset access notation, which takes one of these forms:

Dataset_Expression ["Column_Name"]	returns the value from the first row at the given column name
Dataset_Expression [Row_Index]	returns the value from the given row at the first column
Dataset_Expression [Row_Index, "Column_Name"]	returns the value from the given row at the given column name
Dataset_Expression [Row_Index, Column_Index]	returns the value from the given row at the given column index

For example, this expression would pull a value out of a Table at row 6 for column "`ProductCode`":

```
{Root Container.Table.data}[6, "ProductCode"]
```

Note that you'll often have to convince the expression system that what you're doing is safe. The expression language can't tell what the datatype will be for a given column, so you may have to use a *type-casting* function to convince the expression language to accept your expression, like this:

```
toInt({Root Container.Table.data}[6, "ProductCode"])
```

Functions

The expression language's functions are where much of the real power lies. A function may take various arguments, all of which can themselves be any arbitrary expression. This means that you can use the

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results of one function as the argument to another function. In general, the syntax for a function call is:
functionName(expression1, expression2, ...)

The rest of this user manual section is devoted to the various functions available.

Whitespace and Comments

Whitespace, such as spaces, tabs and newlines, are largely ignored in the expression language. It is often helpful to break your expression up onto multiple lines for clarity. Comments are delimited by two forward slashes. This will make the rest of that line be ignored. This example shows an `if` function spread over 4 lines with comments annotating the arguments.

```
if( {Root Container.UseTagValueOption.selected},
    {MyTags/SomeValue}, // Use the tag value
    "Not Selected",     // Use default value if the user doesn't check the box
)
```

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Part VII

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7.1 Using HTML in Ignition

A lot of components in Ignition accept HTML. Using HTML enables you to add a unique look to your project. As an example, many users wish to have text on buttons and labels wrap onto multiple lines. This is a formatting feature that at first glance appears to be absent from Ignition. This style option is actually easily achievable by simply appending an opening html tag **<html>** to your text. Below is a short list of some of the other ways you can take advantage of HTML within Ignition. This list is not exhaustive so feel free to experiment with other components to see if they accept HTML.

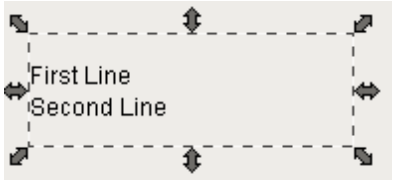
Label Component

The Label component is one of the components that accepts HTML, making it very versatile. A label can display text, images, or both. The text can be HTML formatted. Here are the steps to add HTML to a label:

1. Open the Ignition Designer and drag the Label component from the Display tab of the Component Palette.
2. The Label component has a Text property for what is displayed. By default the text is a single line. We can add HTML to make the label multi-line, bold certain text, underline certain text and more. Set the text property to the following:

```
<HTML>First Line<BR>Second Line
```

The label now has two lines.



Button Component

The Button component also accepts HTML:

1. Open the Ignition Designer and drag the Button component from the Buttons tab of the Component Palette.
2. The Button component also has a Text property for what is displayed. By default the text is a single line. Set the text property to the following:

```
<HTML>Export<BR>To <B>CSV</B>
```

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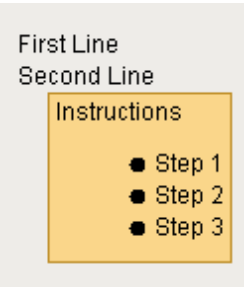
Mouseover Text

One of the most powerful places to use HTML is on the Mouseover Text property that exists on every component. The Mouseover Text is the text that is displayed in the tooltip, which pops up on mouseover of the component. You can display information about the component or the signal it is bound to.

1. Open the Ignition Designer and drag a Label component from the Display tab of the Component Palette.
2. The Label component has a Mouseover property. By default the text is a single line. Set the Mouseover property to the following:

```
<HTML>Instructions<BR><UL><LI>Step 1</LI><LI>Step 2</LI><LI>Step 3</LI></UL>
```

3. Open the client (runtime) and hover your mouse over the component to see the tooltip.



(*NOTE: Here the tooltip w as added to the label from the first example)

Table Component

Another place you can add HTML is the Table component. You can add HTML to the header row or to each of the individual cells of the table. To add HTML to the header:

1. Open the Ignition Designer and drag the Table component from the Tables tab of the Component Palette.
2. In the Property Editor, check the checkbox on the Test Data property to fill in some test data.
3. To change the table's header we need to use the Table Customizer. Right click on the table and select Customizers > Table Customizer.
4. In the header row you can add HTML to the display text in each column. **Note**: If you are using line breaks, you must put them in the first visible column header to set the height. Set the header value of the first column to the following:

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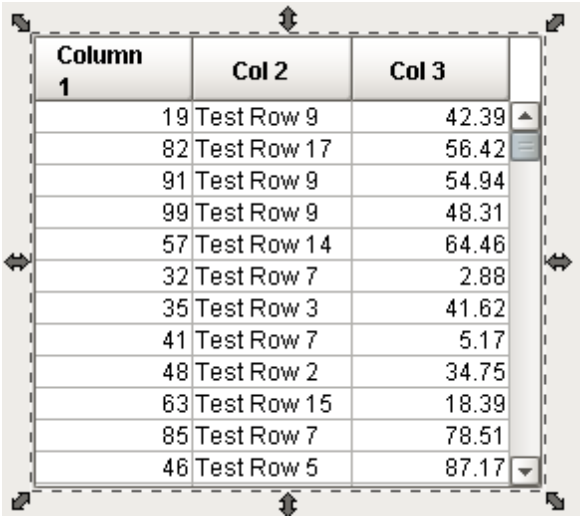
```
<HTML>Column<BR>1
```

Now the table's header has multiple lines.



Column 1	Col 2	Col 3
19	Test Row 9	42.39
82	Test Row 17	56.42
91	Test Row 9	54.94
99	Test Row 9	48.31
57	Test Row 14	64.46
32	Test Row 7	2.88
35	Test Row 3	41.62
41	Test Row 7	5.17
48	Test Row 2	34.75
63	Test Row 15	18.39
85	Test Row 7	78.51
46	Test Row 5	87.17

.

7.2 Kepware OPC-UA Connection Guide

OPC-UA makes connecting to third party OPC servers quick and easy without all the headaches associated with COM. This is a detailed step-by-step guide to connecting to KEPServerEX from Ignition using OPC-UA.

Step 1: Configuring Ignition

1. In the “Configure” section of the Ignition Gateway, navigate to the “Servers” entry on the left-hand side, underneath “OPC Connections”.
2. Click “Create new OPC Server Connection…”
3. Choose “OPC-UA Connection” from the list of connection types.
4. If KEPServerEX is installed on the local machine use the actual IP address of the machine. Do not use localhost.
5. The default KEPServerEX UA port is 49320.
6. Delete the default Username and Password fields. Kepware authenticates clients by using a certificate you will see in a later step.
7. Click “Create New OPC Server Connection”

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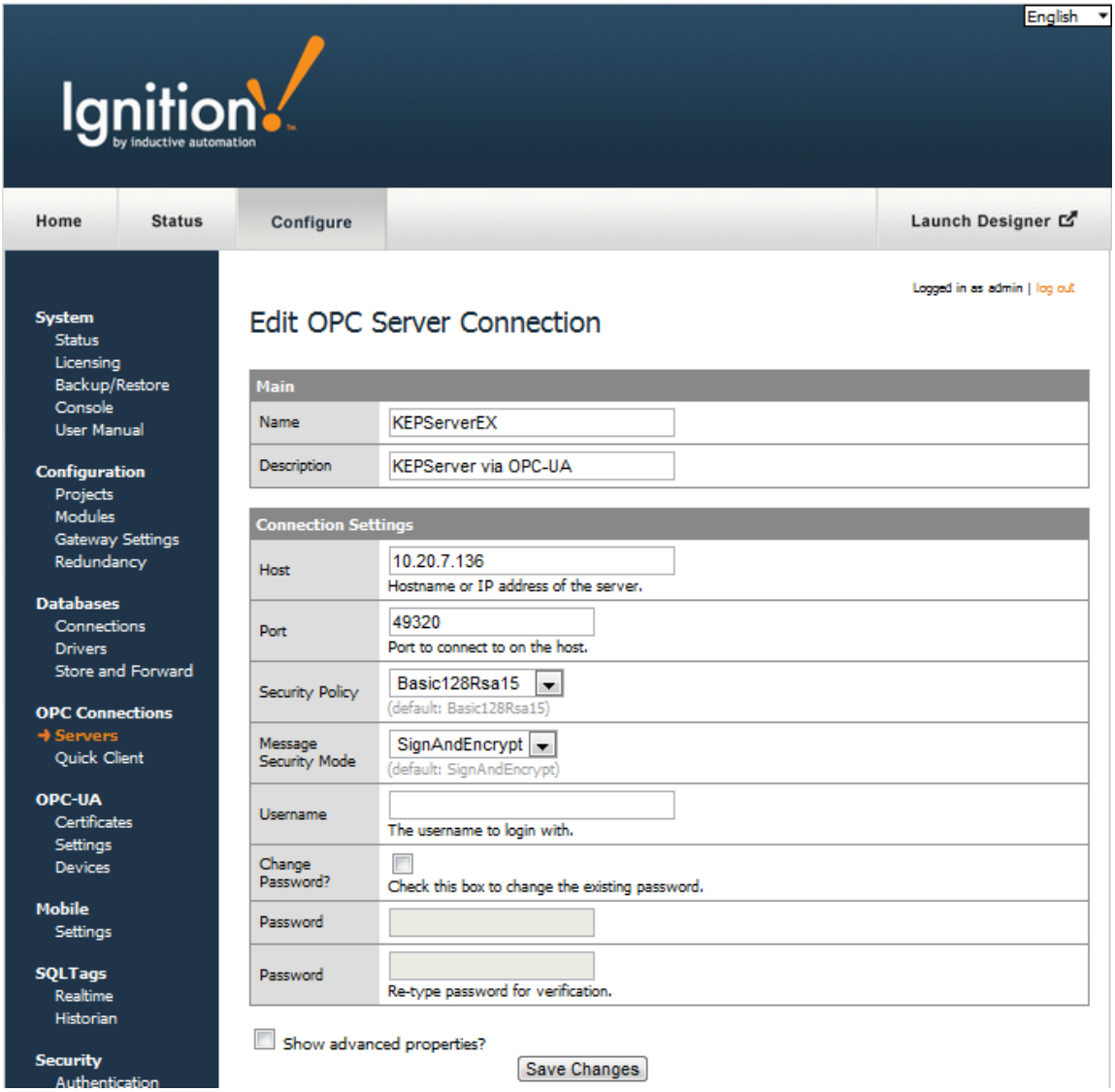

Step 2: Configuring KEPServerEX

1. Right-click on the KEPServerEX toolbar icon and select “OPC UA Configuration”

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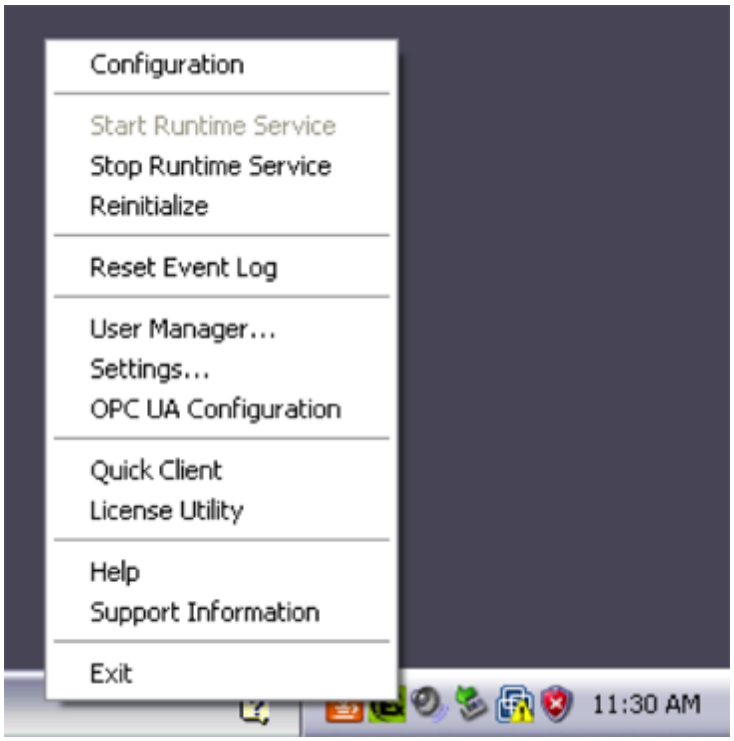
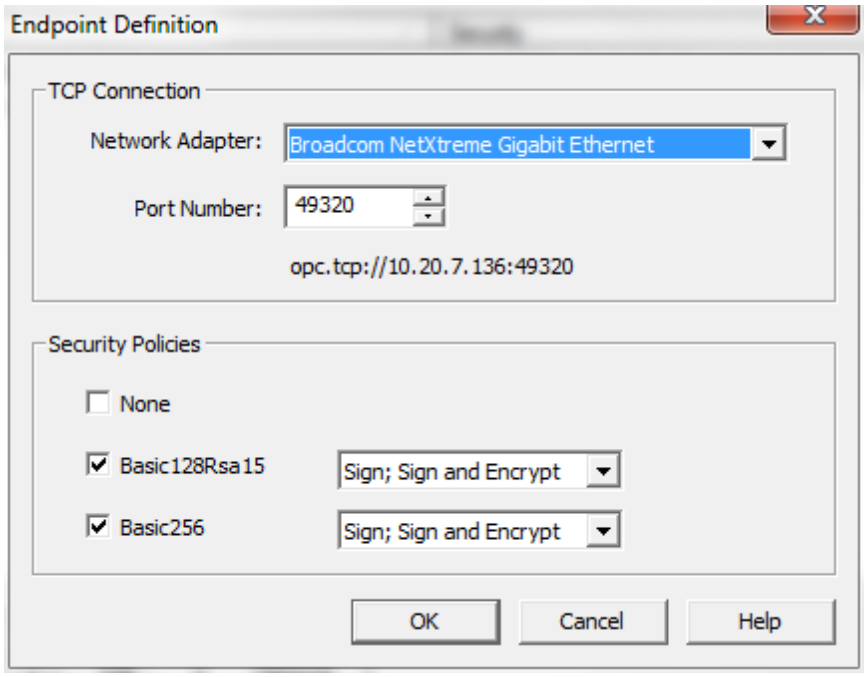


2. Navigate to the “Server Endpoints” tab.
3. If there is already an endpoint present, click “Edit…”, otherwise click “Add…”
4. Choose the correct network adapter for your system. Leave the port alone.
5. Check “Basic128Rsa15” and uncheck “None” and “Basic256”.
6. Press OK.



7. Navigate to the “Trusted Clients” tab.

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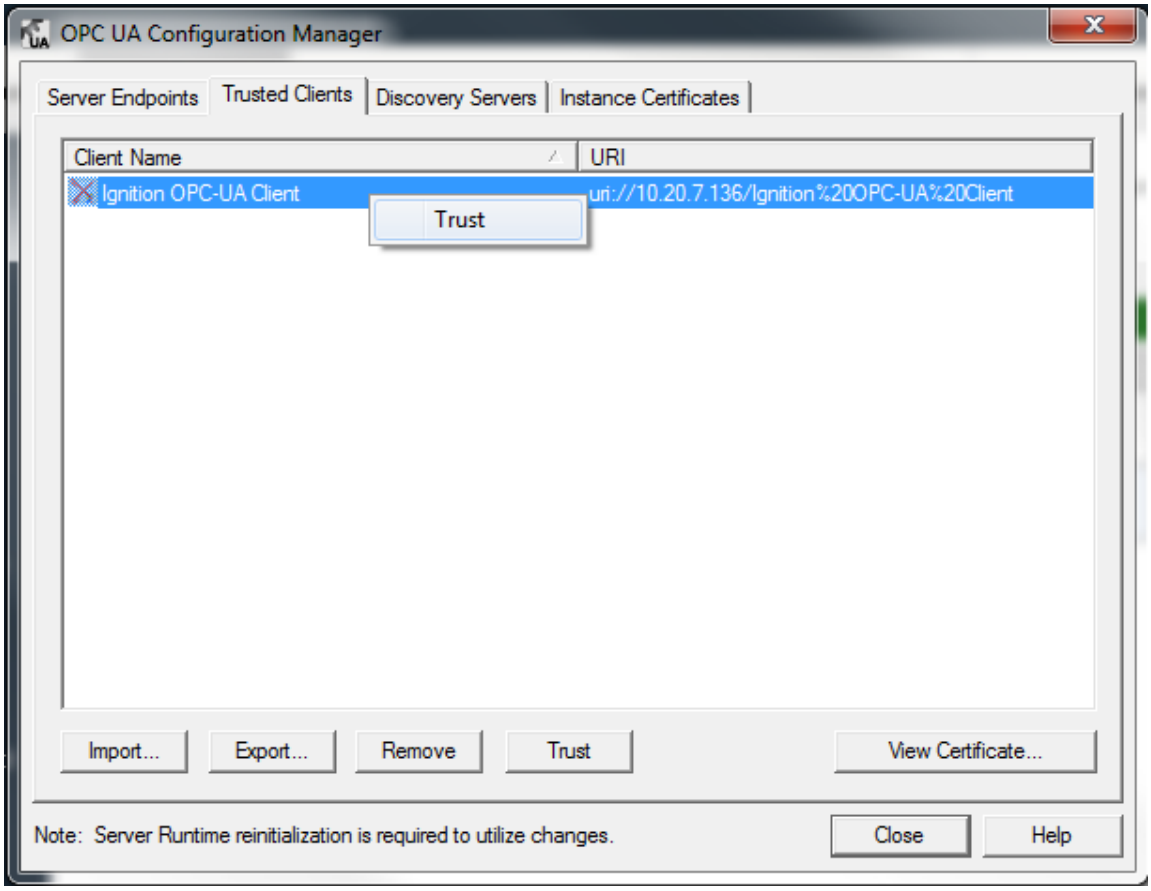
8. There will be a certificate from the Ignition gateway already present but with a red X through it, right click the certificate and select trust.
9. If there are more than one items in this list named 'Ignition OPC-UA Client', delete all of them and wait for Ignition to recreate one. You may have to close this screen and reopen it.



10. Click “Close”.
11. Right-click the toolbar icon and select “Reinitialize”.

Connected!

After following these steps you should have created a successful connection to KEPServerEX and the you should see a status of "CONNECTED" listed next to your new server connection in the Ignition gateway.

If the status does not read connected try clicking the edit link next to the server connection, scrolling down to the bottom of the connection configuration page and then clicking save. In the case where the status of the connection is still reading something other than "CONNECTED" click the "OPC Connection Status" link at the bottom of the OPC Server Connections page and see if there are any useful messages to help troubleshoot the issue. Also ensure that your firewall is not blocking traffic on the port

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that KEPServerEX is using to communicate.

Other UA Servers

While this example is specific to KEPServerEX, the same concepts apply to connecting to any other third party OPC server that accepts OPC-UA client connections. The only difference may be in the way that the certificates are accepted on the server. The Ignition OPC-UA server sends the client certificate to the third party OPC server when it tries to make the connection, however if the OPC server is not designed to expect these certificates then there may not be a straight forward way to accept them. In these cases you can manual download a client ticket from Ignition and supply it to the OPC server in the appropriate manner. To download a client certificate manually follow these steps:

1. Navigate to the Ignition Gateway Configuration page
2. Click the "Certificates" topic link under the "OPC-UA" section.
3. There will be three certificate options under the "This Gateway" tab. Click the download link under the "Ignition OPC-UA Client" section and save the certificate somewhere to disk.
4. This certificate is then supplied to your third party OPC server in a way specific to that server. This can usually be found in the respective server's documentation.

7.3 Troubleshooting Gateway Scripts

Writing an event script that runs on a client (through a client event Script or on a component) allows for easy debugging because a red error message pops up when something goes wrong. In a Gateway Event Script the errors still appear, but because there is no GUI associated with it, they don't show up for the user to see. One might think that these errors would be generated and logged in the Ignition Gateway Console utility, but unfortunately due to how logging works internally this is not the case. These errors are indeed logged and there are a couple places where you can go to find inspect these error messages.

Ignition's wrapper.log

All of the error messages from your Gateway Event Scripts are logged to one file: wrapper.log. You can find this file in the install directory under

```
Version 7.3+ <INSTALL DIR>\Inductive Automation\Ignition\logs\wrapper.log
Version 7.2- <INSTALL DIR>\Inductive Automation\Ignition\wrapper.log
```

When you open this file, scroll to the bottom to see the newest messages. If you have just started Ignition for the first time you will see something like this:

```
STATUS | wrapper | 2011/11/23 10:47:09 | --> Wrapper Started as Service
STATUS | wrapper | 2011/11/23 10:47:09 | Java Service Wrapper Standard Edition 32-bit 3.5.4
STATUS | wrapper | 2011/11/23 10:47:09 |   Copyright (C) 1999-2010 Tanuki Software, Ltd. All Ri
STATUS | wrapper | 2011/11/23 10:47:09 |     http://wrapper.tanukisoftware.com
STATUS | wrapper | 2011/11/23 10:47:09 |   Licensed to Inductive Automation for Ignition Gatewa
STATUS | wrapper | 2011/11/23 10:47:09 |
STATUS | wrapper | 2011/11/23 10:47:09 | Launching a JVM...
INFO | jvm 1 | 2011/11/23 10:47:09 | WrapperManager: Initializing...
INFO | jvm 1 | 2011/11/23 10:47:10 | Nov 23, 2011 10:47:10 AM org.apache.catalina.startup.Embed
```

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```
INFO | jvm 1 | 2011/11/23 10:47:10 | INFO: Starting tomcat server
INFO | jvm 1 | 2011/11/23 10:47:10 | Nov 23, 2011 10:47:10 AM org.apache.catalina.core.Standard
INFO | jvm 1 | 2011/11/23 10:47:10 | INFO: Starting Servlet Engine: Apache Tomcat/6.0.18
```

This file is in constant use by the Ignition system and is being modified in realtime. It is recommended that you download a tool like Wintail that will allow you to view the tail-end (hence the name) of the changing wrapper.log without having to constantly reopen the file.

Output to the wrapper.log file

Gateway Event Script errors are not the only handy bits of information logged to the wrapper file. Print statements that you add to your Gateway Event Scripts are also output to the wrapper.log file. Print statements can be extremely helpful in troubleshooting tricky pieces of scripting. Adding a few simple print statements can help you see values of variables as a script is being executed, or even allow you to see how far your script is getting if it is seeming to merely stop with out throwing an error.

1. In the designer go to the Gateway Event Scripts found under `Projects > Event Scripts (Gateway)`
2. Click on the Timer option and add a new timer script with the default settings.
3. Add this code to you Timer Script:

```
print "Hello World"
```

4. Click OK and then save your project.

Your script will now be running every second and you will begin to see messages appear in the wrapper. log file similar to the following:

```
INFO | jvm 1 | 2012/8/23 11:12:56 | INFO [Project[IADemo] ] [11:12:56,044]: Restarting gateway
INFO | jvm 1 | 2012/8/23 11:12:57 | Hello World
INFO | jvm 1 | 2012/8/23 11:12:58 | Hello World
INFO | jvm 1 | 2012/8/23 11:12:59 | Hello World
INFO | jvm 1 | 2012/8/23 11:13:00 | Hello World
```

If an error is generated in your script is will show up in the wrapper looking something like:

```
INFO | jvm 1 | 2011/11/23 11:20:36 | ERROR [TimerScriptTask ] [11:20:36,310]: Error executing g
INFO | jvm 1 | 2011/11/23 11:20:36 | Traceback (innermost last):
INFO | jvm 1 | 2011/11/23 11:20:36 |   File "<TimerScript:IADemo/test (1000) [Delay, Shared]>",
INFO | jvm 1 | 2011/11/23 11:20:36 | TypeError: write(): expected 2-3 args; got 1
INFO | jvm 1 | 2011/11/23 11:20:36 |
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.Py.TypeError(Py.java)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyReflectedFunction.throwError(PyRe
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyReflectedFunction.throwArgCountEr
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyReflectedFunction.throwError(PyRe
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyReflectedFunction.__call__(PyRefl
INFO | jvm 1 | 2011/11/23 11:20:36 |     at com.inductiveautomation.ignition.common.script.Scri
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyObject.__call__(PyObject.java)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyObject.invoke(PyObject.java)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.pycode._pyx1.f$0(<TimerScript:IADemo/tes
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.pycode._pyx1.call_function(<TimerScript:
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyTableCode.call(PyTableCode.java)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.PyCode.call(PyCode.java)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at org.python.core.Py.runCode(Py.java)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at com.inductiveautomation.ignition.common.script.Scri
INFO | jvm 1 | 2011/11/23 11:20:36 |     at com.inductiveautomation.ignition.common.script.Time
INFO | jvm 1 | 2011/11/23 11:20:36 |     at java.util.TimerThread.mainLoop(Unknown Source)
INFO | jvm 1 | 2011/11/23 11:20:36 |     at java.util.TimerThread.run(Unknown Source)
```

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Here the error message is split over two lines:

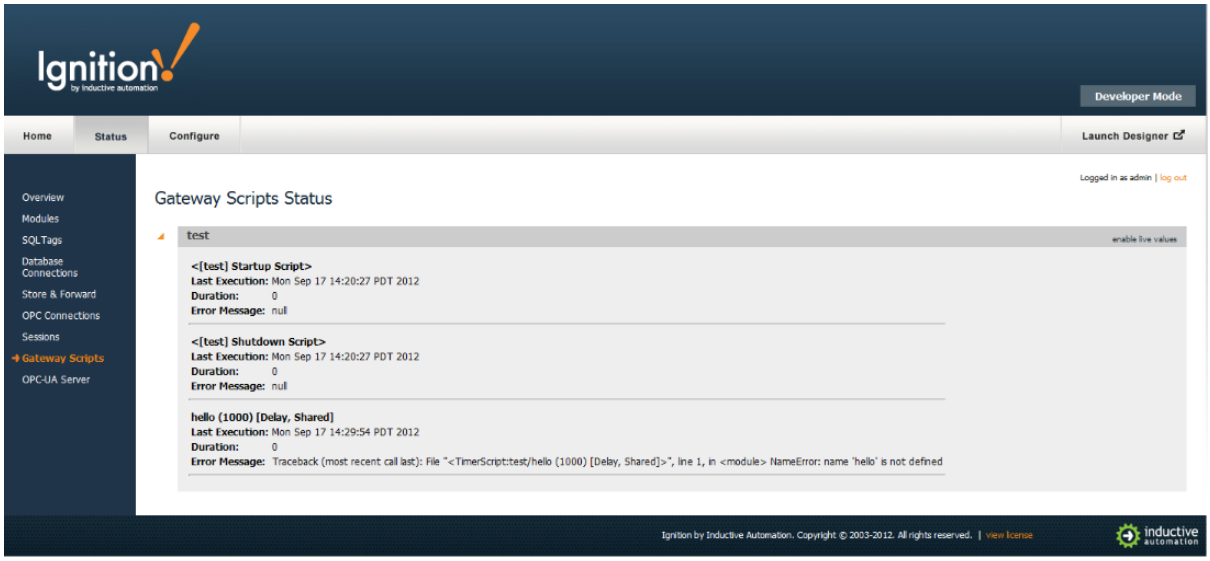
```
File "<TimerScript:IADemo/test (1000) [Delay, Shared]>", line 1, in ?
```
and
```
TypeError: write(): expected 2-3 args; got 1
```

There was no code snippet here but there should be enough information presented to get a pretty good idea of what went wrong.
The first part of the error gives the type of script, project name, and script name in which the error occurred. The line number of the script on which the error occurred is also presented.

Part two of the error is a little more cryptic but still decipherable if you are familiar with some of Ignition's built in scripting functions. One of the built in functions is system.tag.write(), this function takes 2 - 3 arguments as per its documentation in the user manual under Appendix C. This error message is reporting that only one argument was received. With this information one should be able to locate the script that's causing the error and make the appropriate edits to resolve the issue.

Gateway Script Status Page

The Gateway Script Status Page is exactly what it sounds like. The status' of all different gateway scripts homed in the different projects located on the gateway are displayed for easy viewing on this page. They are grouped by the project that they reside in and display any errors that may have occurred during the last execution of the script. This status page does not show things like print statements. The only place to view those is in the wrapper.log file as described above.



7.4 Changing Memory Allocation for Ignition

There are many reasons that a user may want to change the amount of memory that is allocated to Ignition. While most users find that the default memory allocation to be satisfactory, some may have solutions that require altering the max Java Heap size. Installations with subscriptions to several hundred thousand tags may find the default value of 1024MB to be too small. A system with a hundred different device connections may see its memory consumption increase quite a bit which in turn may negatively impact the performance of the system. Another scenario might include a memory constraint on the

machine that Ignition is being installed and if the proposed solution is rather limited then the default 1024MB may be excessive; the initial heap size may also be too large.

Ignition makes these memory settings available for you to adjust to best fit your personal requirements. These settings are found in the *ignition.conf* file which is located:

```
<INSTALL_DIRECTORY>Inductive Automation\Ignition\data  (Windows
installations)
or
/var/lib/ignition/data   (default Linux installations)
```

Java Heap - A Quick Overview

The Java Heap is basically just a chunk of memory that is used by a Java program during runtime. Memory from the heap is allocated whenever an object is created during the runtime execution of the Java program (this is a simplistic description but it is good enough for the purposes of this section). As objects are created by the Java program, memory is allocated to the heap. When objects are collected by the Java garbage collector after they are no longer in use, memory is released from the Java Heap.

In Ignition, things like SQLTags and device connections are objects that are created and stored in memory (or rather, pieces of them are stored). The more tags you drag into Ignition and the more device connections you create the more memory that is needed to keep track of everything. This memory is allocated to the Java Heap.

There is a limit to the amount of memory you can allocate to the heap if you are using 32 bit Java and Ignition. 32 bit Java will only allow you to specify a max heap size of 1536MB or less (in Windows systems). The limit imposed when using 64 bit java is extremely large and there shouldn't really be any concern about hitting this cap.

Changing the Heap Size

Note: *If you feel that you need to allocate more memory for Ignition to use then the first step would be to install the 64 bit version of Ignition along with 64 bit Java. 32 bit Java does not allow you to allocate more than 1536MB to the Java Heap space which really does not give you much of an increase in size. Systems that are expected to be large in terms of tag count should plan on being installed and run on a 64 bit machine.*

How much memory is allowed to the Java Heap can be specified when a Java program is initially launched. There are two parameters that Ignition makes available to you to modify:
wrapper.java.initmemory - This specifies the size to initially allow the Java Heap.
wrapper.java.maxmemory - This specifies the maximum size that the Java Heap is allowed reach as it grows

Again, these settings are found in the *ignition.conf* file. You can edit this file with a normal text editor, however you will likely have to have administrator privileges to save the changes. In windows you can just right click the icon of the text editor you wish to use and select "Run as administrator ".

Once you have the file open:

1. Search for "wrapper.java.maxmemory"
2. Adjust the value as you see fit
   ***Note:** Acceptable values are multiples of 8 (1024, 1536, etc). If 32 bit, do not increase this to anything larger than 1536

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3. Save and close the file
4. Restart the Ignition service

Ignition Service Will Not Start After Modifying Java Heap Space Settings

If you run into the case where the Ignition service fails to start after you have adjusted the Java Heap space settings it merely means that you have likely allocated too much (or too little) memory. This is something that is common when adjusting the heap space settings on a 32-bit machine. While the upper limit on a 32-bit machine is 1536MB, sometimes the operating system won't be able to allocate this much contiguous space in memory. Just follow the steps from above and start lowering the memory incrementally (remember, multiples of 8) until the Ignition service is able to start and function normally.

7.5 Mapping a Network Drive

Windows makes it possible to map drives on network servers to local drive letters so they can be accessed by users as if they were a local drive. The problem, however, is that Windows is not very consistent about how it handles such mapped drives when accessed from a Windows Service, such as the Ignition Gateway. When the service is started manually, the drives will be available, but when the system is rebooted, the service will no longer be able to access them. There may be users that wish to read or write data in Ignition using shared drives, and don't want to manually set up shared drives each time.

**** NOTE: Must be using Ignition at least 7.5 and Java Service Wrapper 3.5.4 ****

To make shared drives available to Ignition on startup, place the following lines in the *ignition.conf* file, which is located in the data folder of the main Ignition installation folder (usually C:\Program Files\Inductive Automation\Ignition\data for Windows users):

```
wrapper.share.1.location=\\fileserver\folder
wrapper.share.1.target=Z:
wrapper.share.1.type=DISK
```

Change the appropriate data for location and target to match the computer's actual setup. If your shared drives require authentication, add the following lines, filling in the appropriate data for user, domain, and password:

```
wrapper.ntservice.account=user
wrapper.ntservice.password=password
wrapper.share.1.account=domain\user
wrapper.share.1.password=password
```

To turn on debugging to see what is causing network share connection issues, make sure to enable *wrapper.debug = TRUE* by removing the pound (#) sign in front of that line of code. The location of the log file is in the main Ignition installation folder as *wrapper.log.*

Other Notes:

Un-map drive on shutdown:
`wrapper.share.1.shutdown.unmap=TRUE`
How often to retry server connection:
`wrapper.share.1.startup.max_retries=2`
What interval (seconds) between retries:
`wrapper.share.1.startup.retry_interval=10`

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Set wrapper to fail to startup if network share not found:
```
wrapper.share.1.startup.failure=SHUTDOWN
```

Troubleshooting:
Here a couple of the common problems that are encountered when mapping network shares:

Server not found

The debug output will show something like this if a drive can't be reached:

```
wrapper | Attempting to map the "\\fileserver\folder" share to "S:"...
wrapper | Unable to map "S:". Attempt #1 (The network name cannot be
found. (0x43))
wrapper | Attempting to map the "\\fileserver\folder" share to "S:"...
wrapper | Unable to map "S:". Trying to continue. (The network name
cannot be found. (0x43))
```

Incorrect Login Data

If the configured account or password are incorrect (or are missing) then the mapping will fail with a message like the following:

```
wrapper | Attempting to map the "\\myfileserver\commonshare" share to
"S:"...
wrapper | Unable to map "S:". Trying to continue. (Access is denied.
(0x5))
```

7.6 Creating an Editable Table in Ignition

The table component in Ignition makes displaying data retrieved from SQL queries a snap, however there are many times when you want to do more than just display the data to the user. In many cases you would like the user to be able to interact with the table directly, edit data within the cells and then have those edits be reflected in the database. Many first time Ignition users think that merely making a column "editable" in the table customizer will achieve this. They quickly find out that this is not the case and are often confused as to why. The table component does not have any built in functionality to write back to your database.

To make a table truly "editable" you have to use a combination of making the columns of the table "editable" in the customizer and then responding to the `cellEdited` events with scripting. Below is a brief overview on how to create and editable table. This example references a hypothetical table "customers" that exists already in the database. You would of course modify this example to fit your needs.

Part 1 - Set up the Table Component

1. Add a table component to a window
The first step is to drag in a Table component, from the Tables tab on the Component Palette, into a Window.

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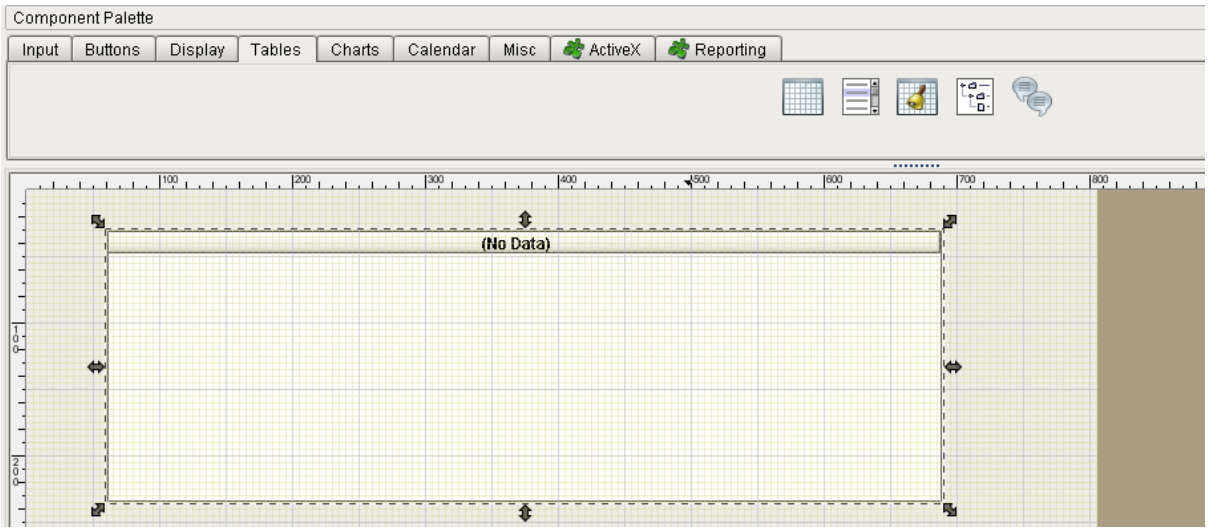
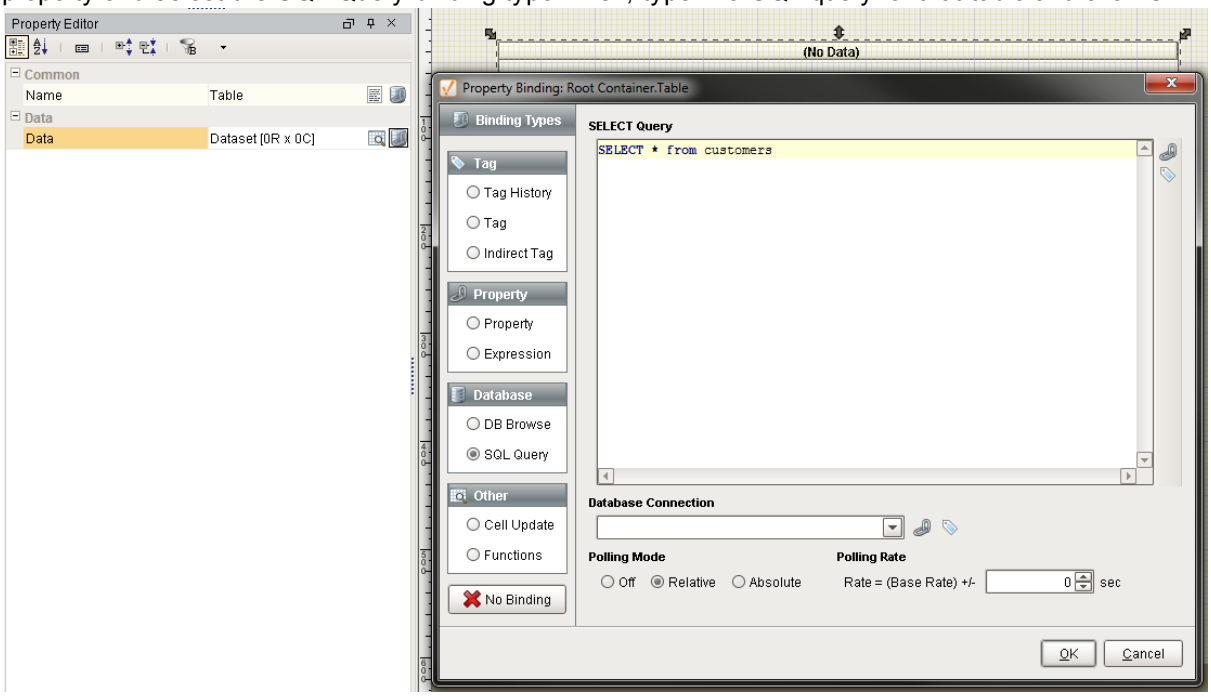


2. Link the Table to an SQL Query

Once the table is in the window, the next step is to bind the Data property to a SQL query pointing to the table you want to edit in the database. To do this click on the Bind icon to the right of the data property and select the SQL Query binding type. Then, type in a SQL query for that table and click OK.



3. Select Which Columns are Editable

Now that the table component is showing data, you need to set which columns will allow the user to edit in the run-time. This way a user can double-click in any cell in those columns to change the value. To do this, right-click on the table component and select Component Customers -> Table Customizer.

The Table Customizer is where you configure the columns' display properties, as well as any row mapping configuration. When you open the Table Customizer, you will see a table that has all of your data's columns across the top, and all of the column display properties across the left. You can

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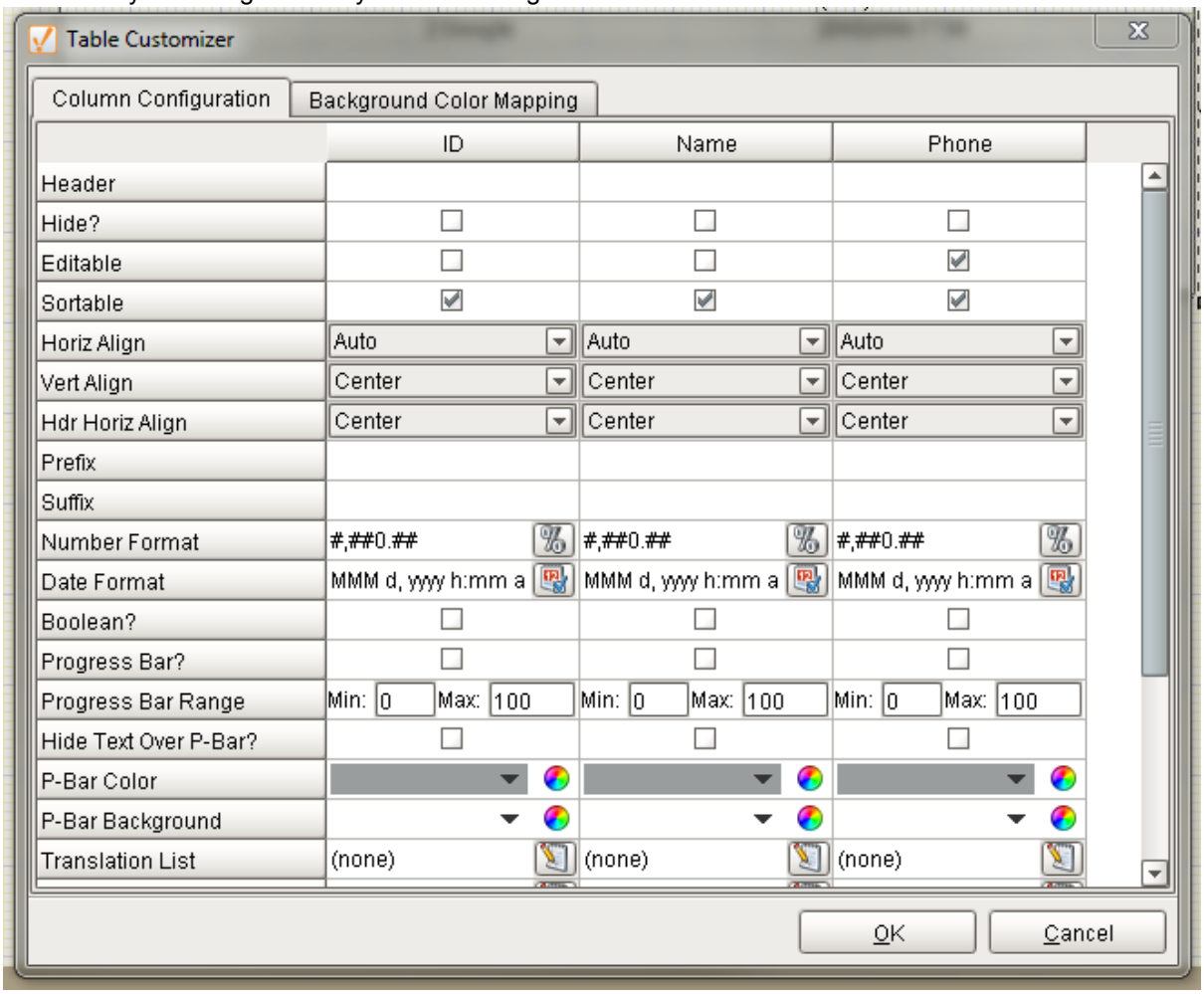
configure each column to have its own display properties. Once such column display property is called Editable. By checking the box you are allowing that column to become editable in the run-time.



Part 2 - Add the Scripting

Any time a user double-clicks in an editable cell and changes the value, all valid changes will be reflected back in a change to the table's data property. The SQL table does not get updated automatically. At this point, all changes can be mapped back to a database in scripting.

Once a valid change has been made, the table will fire a cellEdited event that contains the row, column, previous value, and new value for the cell. Remember, if the table's data is bound to a polling query binding, the edited dataset will be overwritten with whatever is in the database. You can use the cellEdited event to issue a SQL UPDATE query that will make the edit in the database as well.

To create a script that will issue the SQL UPDATE query, right-click on the table component and select Event Handlers. Here you can respond to events that get fired, such as a mouse-click or cell edited event. On the left-hand side, you will see a cellEdited event under the cell folder. Select the cellEdited event and then select the Script Editor tab on the right-hand side. Here you can create a small script that will issue the UPDATE query. The following is an example:

```
# The row index of the edited row
row = event.row
# The column index of the edited column
```

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```
col = event.column
# The column's name
colName = event.source.data.getColumnName(col)
# The new value
value = event.newValue
# The primary key's value (first column), so that the appropriate row can be updated in the db
id = event.source.data.getValueAt(row, 0)

# Run an update query to the table that is being edited to reflect any changes
system.db.runPrepStmt("UPDATE customers SET %s = ? WHERE ID = ?" % colName, [value, id])
```

Again, this script will run any time a user makes a valid edit to one of the editable cells in the table.

7.7 Create Basic Navigation Windows

Understanding how navigation works in Ignition is very important. There are several different navigation strategies you can create in Ignition. This how-to covers the most basic and widely used navigation strategy where you have a single window visible at a time. The how-to also covers how windows resize with different screen resolutions.

Part 1: Understanding Windows & Navigation

Every Ignition project contains a collection of Windows. Windows are the fundamental building blocks for projects using the Vision module. Windows contain a hierarchy of components. Components are visual elements that range in complexity from a single Button and Label, to the powerful Easy Chart and Table components.

In the client (aka runtime) the only way to see contents of a window is if the window is opened. There are two ways a window can get opened in the client:

> Open on Startup - Window is set to open after login screen.
> Opened through Scripting - Window is opened from some event: clicking a button, tag change, key press, etc.

The first part to consider when configuring a new project is what windows you want to open on startup (once a user logs into the client). These windows are going to be the first thing that a user will see. In a typical navigation strategy you will have two windows open on startup: one docked and one main window (filling in the rest of the space). From these windows other windows can be opened and closed.

At any given time any number of windows can be opened in the client. You can see how many windows are opened using the Windows menu bar item. Keep in mind, any window that is opened may need resources such as running SQL queries or getting tag values. It is not a good idea to just keep opening windows since each window is running. Whatever windows a user is not using should be closed.

The second way a window can be opened is through scripting. Ignition provides you with a number of built-in system functions to accomplish tasks such as opening, closing, centering, and swapping windows.

system.nav.openWindow
system.nav.openWindowInstance
system.nav.swapWindow
system.nav.swapTo
system.nav.goBack

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system.nav.goForward
system.nav.goHome

We will cover a few of these functions in this how-to. Next, let's look at the three typical window types in Ignition.

By manipulating a window's properties, you can transform it into various configurations. Typically, you choose what kind of window you want when you create the window. However you can also alter the window's Dock Position, Border Display Policy, Titlebar Display Policy, and Start Maximized properties to change windows into one of three categories:

Main Windows
Docked Windows
Popup Windows

A main window is one that is set to start maximized, and has its border and titlebar display policies set to When Not Maximized or Never. This will make the window take up all available space (minus space used by any "docked" windows). This makes the window act much like a typical "HMI screen." You may also see these referred to as "main" windows, typically when referring to the currently visible one. You can create a main window by right clicking on the Windows section in the project browser and then selecting "Main Window".

A "docked window" has the Dock Position set to anything but Floating. This will make the window stick to one side of the screen, and nothing can overlap it. It will also typically have its border and titlebar display policies set to Never. This makes the "docked" window appear to be joined seamlessly with the current "screen" window.

These windows are usually tall and skinny or short and wide, depending on the side they're docked to. The purpose of a docked window is to make some information always available; typically navigation controls and overall status information. Using docked windows can help eliminate repetitive design elements from being copied to each screen, making maintenance easier. You can create a docked window by right clicking on the Windows section in the project browser, selecting "Docked Window", and then specifying it's dock position and window size.

A "popup window" is a window with the Dock Position set to Floating and is not maximized. Its border and titlebar display policies are usually set to When Not Maximized or Always, so that they can be manipulated by the end-user. These windows are often opened by components in the current "screen" window, and are meant to be on top of the screen. To this end, they may have their Layer property set to a number higher than zero so they don't get lost behind the "screen" window. You can create a popup window by right clicking on the Windows section in the project browser, then selecting "Popup Window".

Popup windows are often parameterized so they can be re-used.

Part 2: Basic Navigation Strategy

The typical navigation strategy for a project is to have a "docked" window or two (usually docked north and/or west) and a single main window visible at a time. For example, you may have a header window docked north with your company logo, navigation buttons and status information. You may also have an overview window opened as the main window. If you want to switch the overview window with a historical trending window then you want to swap the two windows. Swapping ensures that only one window is open at a time. Popup windows do not fall under this category since they are not main windows.

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This style of project is so common, that the default operation of the Tab Strip component expects it. When it is in its default automatic operation, it expects that each tab represents a main window, and will automatically swap from the current screen to the desired screen. Furthermore, the [System]/Client/User/CurrentWindow tag is calculated based upon this strategy: its value is the name of the current maximized window. If you have more than one main window open a time this navigation strategy will fail since the system expects a single main window.

** Note: If your Tab Strip or swapTo function is not working as you expect, check to see if you have more than ONE main window opened.*

The Tab Strip component works off of the current window variable. When a project first loads, the variable will hold the main window set to open on startup. The Tab Strip utilizes the system.nav.swapTo function which swaps from the current window (stored in that variable) to a new window and updates the current window variable. At any time you can perform a system.nav.getCurrentWindow() or check the [System]/Client/User/CurrentWindow tag to see what Ignition thinks the main window is. If you have two main windows opened Ignition will be confused as to which one you want to perform the swap.

If you want to use your own buttons or other component to perform the navigation just make sure to use the system.nav.swapTo instead of the system.nav.swapWindow. The system.nav.swapWindow function takes a window to swap from and a window to swap to. The function does not utilize the current window variable in Ignition.

** Note: The system.nav.swapWindow is the default function when swapping is selected on the Event Handler Navigation tab.*

As swapping occurs in the client a history of windows is stored internally. You have the ability to go backwards or forwards through this history (array) using the system.nav.goBack and goForward functions. The system.nav.goHome function simply takes you to the first main window that was opened in the client, which typically is the main window set to open on startup.

To open popup windows you just simply need to open the window using the system.nav.openWindow or openWindowInstance.

Part 3: Setup Basic Navigation Windows

1. First, we need to create the "docked" window as our header window to display the logo, tab strip and information. In the designer, right click the Windows section in the Project browser and select Docked Window or use the File > New > Docked Window menu item. On the New Docked Window dialog that pops up select a Dock Position of North.

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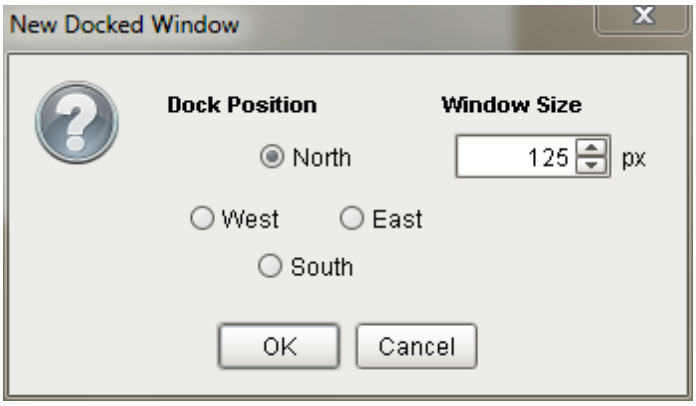
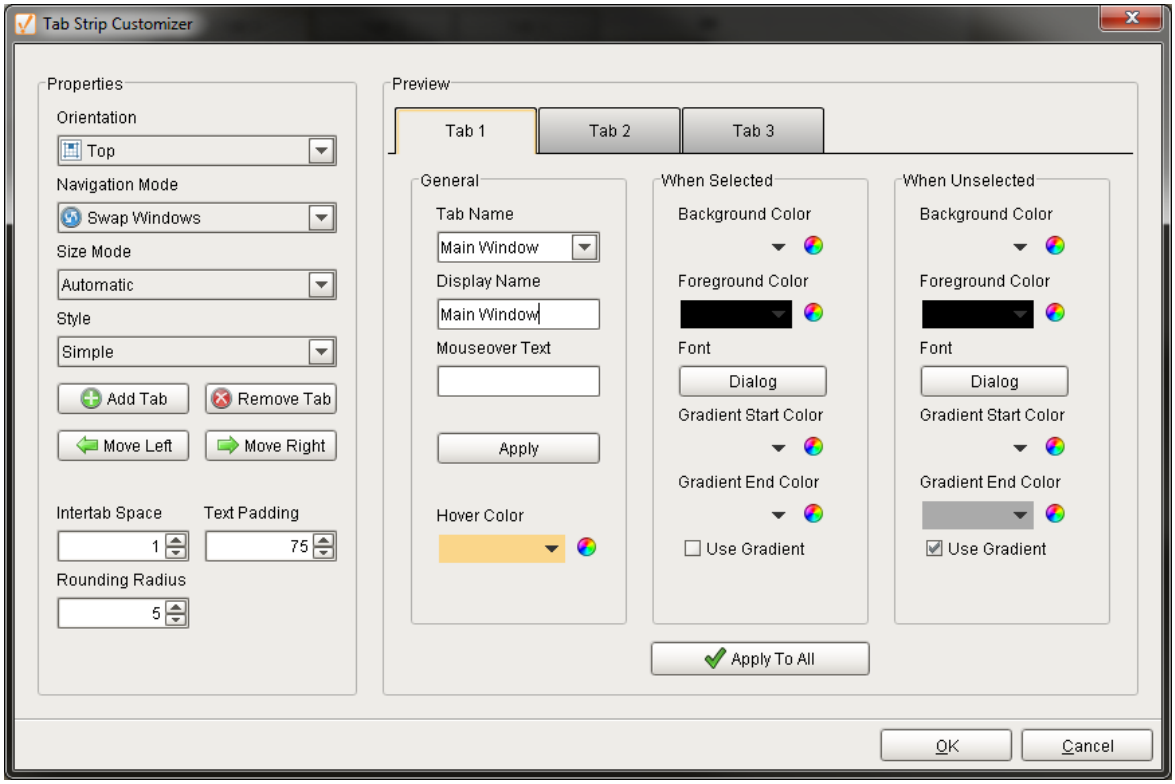


2. Right click on the new window in the Project Browser and select Rename or press F2. Rename the window to Navigation.
3. We need this window to open on startup so right click on the window in the Project Browser and check the Open On Startup box if it is not checked.
4. You can add your company logo and navigation buttons to this window, but this example will use the tab strip. Drag in the Tab Strip component from the Buttons tab of the Component Palette.
5. Now we need to configure the tabs. Right click on the Tab Strip component and select Customizers > Tab Strip Customizer. There you can alter, add, or delete tabs. In order to make swapping work select the window to swap to from the dropdown menu. The Display Name can be whatever you want.



6. Now we just need some main windows. Create a main window by right clicking the Windows section

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in the Project Browser and selecting Main Window

7. Go ahead and make more main windows. Make sure the main window you want to open on startup has the flag checked like we did with the Navigation window above.
8. With your new main windows created, go back to the tab customizer and set up the other tabs to point to these new windows like we did in step 8.

Part 4: Client Resizing and Minimum Size

How windows and components resize to different resolutions is always a key topic for Ignition. Windows are the easiest to talk about first. Only two types of windows will resize automatically: ones that are docked and ones that are maximized. Docked windows will only resize in either the height or width, but not both (depends on dock position). Maximized windows will resize in both in width and height. Both of these are governed by the client size. Smaller resolutions will have smaller sizes and larger resolutions can have larger sizes. Users have the ability on popup windows to resize them manually.

Components inside of windows will only resize if the window they are in resizes. How that component resizes is up to the layout of the component. There are two layout modes, and they are set on a per-component basis. Both affect the component's size and position relative to its parent container. The root container's size is dictated by the window size.

Relative layout is the default mode. This is a simple but effective layout mode that simply keeps a component's size and position relative to its parent container constant, even as the parent container grows or shrinks. More precisely, it remembers the component's position and size as a percentage of its parent's bounds at the last time the window was saved. Relative layout also has the option of scaling a component's font appropriately.

Anchored layout lets you specify various "anchors" for the component. The anchors dictate how far each of the four edges of the component stay from their corresponding edges in the parent container. For example, if you anchor top and left, then your component will stay a constant distance from top and left edges of its parent. Since you didn't specify an anchor for the right or bottom sides, they won't be affected by the layout.

Typically components inside of docked windows have an anchored layout. Components inside of main windows and popup windows usually are relative but can be a mixture of the two.

Client Minimum Size

Clients can define a minimum size, because even with dynamic layout, you usually don't want the client to get too small. This is because it would become unusable and unreadable. This is what the Minimum Size property is for. By default it is set to 800x600, but you can adjust it in the designer under Project -> Properties menu item then Client -> User Interface. Simply put, if the size of the client gets smaller than the minimum size the client will get scrollbars instead of resizing the windows inside of it.

7.8 Indirect Bindings and Window Parameters

Using parameterization and indirection in your screens is an important way to reduce the amount of repetitive design work required when creating your project. For example, suppose you have 35 valves that need to be monitored and controlled. By creating one valve control screen and re-using it 35 times, you save time creating your system and you'll save time in the future when you only have to update the

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single valve control screen. There are two concepts that are required to achieve this in Ignition: indirect data binding and parameter passing.

Indirect Data Binding

Indirect data binding is the most important concept to understand in Ignition if you want to avoid a massively repetitive design. The idea here is that your data, whether it is in SQLTags or data in a SQL database, is organized in some predictable pattern. For example, if you had 35 valves's worth of tags in SQLTags, their tag paths would be predictable based upon the valve number:

```
Facility/Valves/ValveX/HOA
Facility/Valves/ValveX/Flow
Facility/Valves/ValveX/OpenPct
```

... where "X" would be replaced with the numbers 1 through 35.

Once your data is organized in a predictable pattern, you can use indirect data binding. Indirect data binding is any data binding where the target of the binding changes based upon some parameter in the window. For example, all of the bindings to display and control the valve would dynamically point to any of the 35 valves based upon a single parameter. If you're unfamiliar with Ignition's data binding, you might want to review the entries in the Property Binding section (Property Binding Overview).

Indirect Tag Binding

The first and easiest way to use indirection is to use the indirect tag binding. The first step is to have some value that you'll use as the indirection parameter. Usually this would be a custom property, often placed on the Root Container of a Window. Let's call it "ValveNumber." Then create the display/control screen for the valve, but instead of using standard tag bindings for your components, use the indirect tag binding. Browse for the appropriate tag from any valve, highlight the valve number in the path, then replace it with {1}. Below in the References section you will see that a new entry has been created with a 1 in the Ref.# column. This refers to the {1} that you replaced the valve number with. Click on the first row in the References section, then click the property icon. Browse down through the property tree until you find the ValveNumber property located on the root container. Now your binding will point to whichever tag is indicated by the value of ValveNumber.

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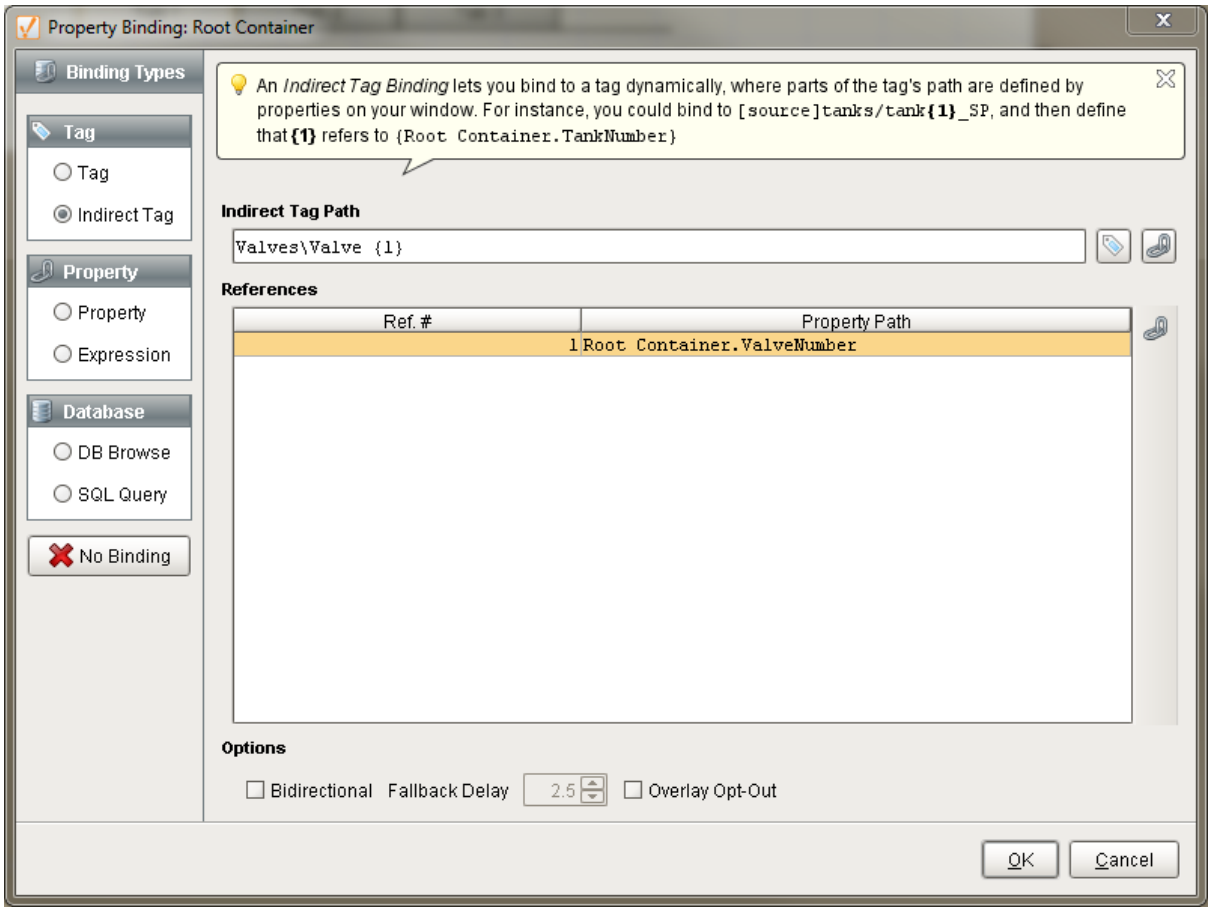

You can add as many references you want. Each reference you add (e.g. {5}) will add a row into the references table. This reference will then be replaced by whatever property value that you map it to. Essentially all you are doing is building a tag path using references as placeholders that are replaced with dynamic values at runtime. To take advantage of this feature though requires some forethought as to how you are going to structure your tags. A good naming convention can make the design process a lot easier.

Indirect Expression Binding

The second kind of indirection is through the expression binding. This is an extremely versatile binding type. In particular, there is the tag() expression, which will return the value of a tag path. The tag path itself can be constructed using other expressions, which can easily be indirect. For example, if we wanted to bind to the valves' "OpenPct" tag and also multiply by 100, we could use an expression like:

```
tag(
   "Facility/Valves/Valve" +
   {Root Container.ValveNumber} +
   "/OpenPct"
   ) * 100.0
```

SQL Query Indirection

Lastly it is worth mentioning that the SQL query binding is also a capable of indirection. The query itself can be altered by embedding the value of other properties. For example, suppose we logged all of our valve's flow rates to a table. We could use a query binding like this to calculate the average flow over the last 15 minutes for our current valve:

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```
SELECT
    AVG(Valve{Root Container.ValveNumber}Flow)
FROM
    ValveFlowHistory
WHERE
    t_stamp > DATE_SUB(CURRENT_TIMESTAMP, INTERVAL 15 MINUTE)
```

Window Parameters

Putting indirect designs like those described above into popup windows is a great way to maximize the benefit of indirection. By passing the ValveNumber into a popup window, we can re-use the same window across our entire project simply by altering the valve number that we pass to the popup window. Passing parameters to windows is simple. Any custom property on the root container of a window can be used as a window parameter. On a button or other control that opens the window, simply call one of the navigation functions via scripting in the following manner:

```
value_to_pass1 = event.source.parent.ValveNumber
value_to_pass2 = event.source.parent.TankNumber

system.nav.openWindow('Main Window', {'TheValveNumber':value_to_pass1, 'TheTankNumber':value_to
```

In the above example TheValveNumber and TheTankNumber are the name of properties residing on the root container of the window that is to be opened. You can only pass parameters to properties that reside on the root container of the window that you want to open.

That's it! When the window is opened, its TheValveNumber property will be set to the appropriate value and the bindings will target the correct valve.

7.9 Database Performance Tips

Database performance is an important thing to keep in mind when designing your database. As your database grows over time, queries will inevitably start to slow down as there is more and more data to search through. Whether you have found yourself in a situation in which your queries are running unusually slow or you are just starting the design and setup of you database, below are a few suggestions that can help fine tune the performance of your database.

Properly index columns

Creating an index on a column tells the database that you're going to reference it often in order to locate data. A well placed index can dramatically affect query speed, sometimes taking queries down from minutes to sub-second. However, creating too many indexes can have a negative result so only create indexes that are relevant to your queries on that table. Also, creating multi-column indexes can be effective, but more often than not is less helpful than expected. Any column that is often used to look up or narrow down data is a good candidate for an index. For example, almost every query on a historical table would reference the timestamp column, so indexing that column would be a wise idea. Tables that are created by the SQLTags Historian already have indexes created by default, so unless you notice some very long running queries on the Historian queries you shouldn't have to worry about these tables.

Give your machine plenty of RAM, and use it

Having a good amount of RAM on your database machine lets it hold more information in memory, reducing slow disk access. Given the low cost, it can be one of the most economical hardware based improvements, as well. Be aware, however, that you may need to configure the database to take advantage of it- many databases have settings that limit the amount of memory the system can use. Documentation on the specific database engine you are using will have information on how to adjust the memory usage settings.

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Select your "engine" wisely

Some database systems, such as MySQL, support multiple "data engines", or methods of storing data. The different engines each have their strengths and weaknesses, and by being informed and choosing wisely you can significantly improve system performance. For example, the InnoDB engine has good transactional support. However, in many cases this is not crucial, and the performance boost offered by the MyISAM engine is more important. For historical data, the Archive engine can drastically reduce the required disk space; at the trade off of some query speed (indexes aren't supported, though querying an archive table still tends to be faster than a non-index InnoDB or MyISAM table).

Exclude data directory from virus scanner

Many virus scanners include "realtime" components that constantly check changing files for viruses. Since the database interacts frequently with the disk, it can trigger the scanner to execute frequently, killing performance. It is highly advisable to exclude the database's data directory from the list of folders to monitor. Some virus scanners will even have special exclusions that you can setup specifically for databases so make sure you familiarize yourself with whatever virus scanner product you are using so you can learn how to exclude your database from whatever live scan features it may have.

Check your data types

Having columns set to use data type that are larger than the actual data being stored can result in wasted disk space. By selecting the correct data types, you can save space and improve read/write performance.

Avoid sub-queries when JOINs will do

Utilizing JOINs in your SQL Queries allows the database to optimize much more than with sub queries. This results in quicker queries with less memory usage.

Check your SQL Server "auto grow" and "auto shrink" settings

Some database systems, such as Microsoft SQL Server, allow the database to dynamically grow and shrink as data is inserted and deleted. By default, the "auto grow" setting for Microsoft SQL Server is set to grow by 1MB at a time. When data is inserted at a fast rate, the database constantly has to increase the size, leading to disk fragmentation. A general rule of thumb to you can use for testing is to set your "auto grow" setting to about one-eight of the size the table will get. Also, turn off any "auto shrink" settings to prevent that database from constantly growing and shrinking, again leading to disk fragmentation.

Periodically defragment your hard drive

Over time as data is inserted and deleted from the database the disk can get fragmented causing your queries to take longer. Periodically check and defragment your hard disk to avoid this issue.

Check for periodically executing tasks

Some database systems, such as Microsoft SQL Server, can execute tasks, such as stored procedures and back ups, on a schedule. These tasks will run automatically and can affect the performance of the database if executed at the wrong times or if the tasks are not optimized. Periodically check these tasks to find out when they are running and how long they take to execute.

Use database profilers and query analyzers

Many database systems come with profilers or query analyzers that help you see how the database is performing. Profilers are graphical user interfaces that monitor all database events in what's known as a trace file. You can then analyze or use the trace file to troubleshoot logic or performance problems. You can also use the utility to do a stress analysis, fine tune indexes, auditing and reviewing security activity, etc. Query analyzers can be used to recommend indexes for specific tables, find out exactly

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how the database system will execute a given query, and statistics after the query is executed. This tool can help better optimize slower performing queries.

Be aware of database activity

Most database software allow you to set up different "schemas" which many users tend to refer to as "databases"; MS SQL server also allows you to run different instances each with their own multiple schemas. This functionality is great for allowing you design separate databases for use by different applications who all maintain their own connections to the database. An often overlooked side-effect of this functionality is that a user will not actually be aware of the database load due to all of these different connections. If you find yourself experiencing slow running queries when you feel that the load you are putting on the system seems to be rather insignificant keep in mind that there may be many other applications accessing the database. In the situation where there are a lot of different applications putting load on the database there may not be too much you can do to increase performance. Your best bet will be to try increase the memory allotted to the database. If that doesn't work then moving to a dedicated database for use with Ignition may be a better option.

7.10 Accessing Ignition Over a WAN

Some users may wish to access their Ignition Gateway over the Internet or a WAN (wide area network). With a little knowledge of networking practices and administrative access to your network, this capability is easily achievable.

Background

We're going to learn about TCP/IP and networking with Ignition by example. Our setup uses the address range 192.168.0.1-254. This is an example of a non-routable Class C IP network. Class C means that we have 255 addresses to deal with and a 24 bit subnet mask (255.255.255.0). Non-routable means that we're using addresses have been reserved for private (non-Internet) use. This means that Internet routers will ignore requests that use these addresses. Make sure that you use non-routable addresses when setting up private control networks! We have a router set up that has a single legal IP address and provides Internet access to our network with Network Address Translation (NAT). This article is relevant to any setup where you use NAT, port forwarding, or a DMZ (Demilitarized zone, a subnetwork that sits between the internal and external network).

Example Settings

The Ignition gateway uses the static (non-DHCP) address 192.168.0.2 and currently runs over port 8088
The router uses the LAN address 192.168.0.1
The router uses the WAN (Internet) address 69.19.188.26
Clients' addresses are assigned via DHCP in the range 192.168.0.100-150. They need to access the Ignition project
We want to be able to access our application over the Internet

Setup

Our first step to allow access to the Ignition gateway is by setting up a port forward rule in the router. It should specify that TCP traffic directed to 69.19.188.26 over port 8088 be forwarded to 192.168.0.2. You may also need to add an incoming firewall rule to support this with the same settings.

To test, open *http://69.19.188.26:8088* in a web browser. If you see the default Ignition Gateway web site it worked. If not then you can try loosening up your firewall policy and using 192.168.0.2 as the DMZ host. Keep in mind that a home router DMZ host is not a true DMZ in terms of network segmenting - it is a feature that will pass all traffic to our Gateway, with the exception of certain attacks. This is much

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more wide open than a single port forward - more geared toward Internet games that require numerous ports to be open. Incrementally tighten back security as you determine what works.

Next make sure that your firewall doesn't block outbound TCP traffic from your local network over port 8088. In most cases it shouldn't, but our network is very secure so we'll set up an outbound firewall rule to allow TCP traffic from 192.168.0.x to 69.19.188.26 over port 8088. Without this rule, Internet users won't have a problem, but your local clients won't be able to access the system. Your clients should address 69.19.188.26 instead of 192.168.0.2 when using the Ignition runtime. Then restrict gateway configuration access to either 127.0.0.1 (localhost) or 192.168.0.*.

You should now be able to access your Ignition gateway via the internet and launch clients on remote systems.

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Installation / Deployment

Part VIII

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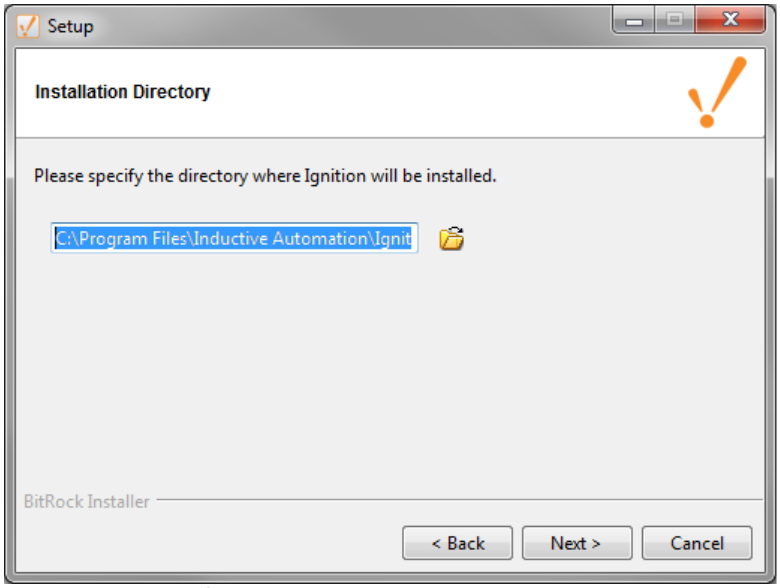
8 Installation / Deployment

8.1 Installation (Windows)

Ignition by Inductive Automation is really easy to install. To get started, simply download the Windows executable installer from our website, and double-click on it. Be sure to download the 32-bit installer for a 32-bit Windows installation, and the 64-bit installer for a 64-bit Windows installation. You can run a 32-bit installer in a 64-bit Windows system, but the 32-bit installation has memory restrictions as compared to the 64-bit installation which does not. After the installer starts, if you agree to the licensing terms, continue on to the next step.



Choosing the Installation Directory

The first option in the installer is to choose where Ignition is installed on your hard drive. The default (your Program Files directory) is usually a good choice. After you have selected your installation directory, click on Next.

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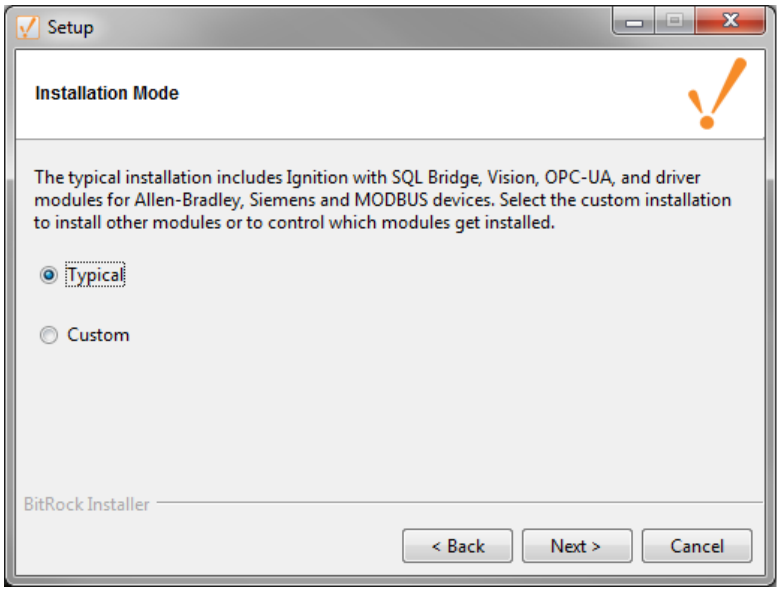
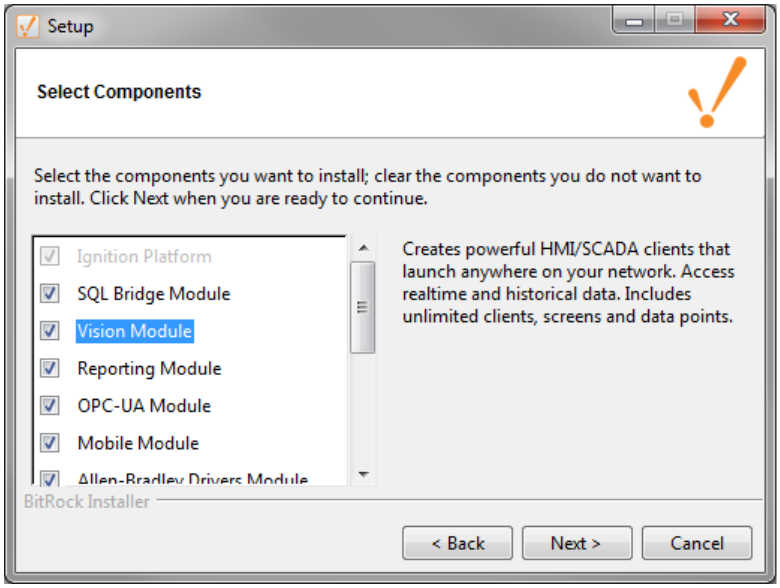

Setup
Installation Mode
The typical installation includes Ignition with SQL Bridge, Vision, OPC-UA, and driver modules for Allen-Bradley, Siemens and MODBUS devices. Select the custom installation to install other modules or to control which modules get installed.
Typical
Custom
BitRock Installer
< Back
Next >
Cancel

Choosing the Installation Mode

The next option in the installer is to choose the installation mode. For most scenarios, the Typical mode will install everything that you need to get started. If you would like to add an optional module, such as the OEE Downtime module, select the Custom mode. You can also use the Custom mode to control which modules get installed. When you have made your selection, click on Next.


Setup
Select Components
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Ignition Platform
SQL Bridge Module
Vision Module
Reporting Module
OPC-UA Module
Mobile Module
Allen-Bradley Drivers Module
Creates powerful HMI/SCADA clients that launch anywhere on your network. Access realtime and historical data. Includes unlimited clients, screens and data points.
BitRock Installer
< Back
Next >
Cancel

Custom Mode module selection

If you have selected Custom Mode, you will be presented with the screen above. To view a brief description of the module, click on the module name. Checking the checkbox next to a module will install the module as part of the Ignition installation. Clearing the checkbox next to a module will prevent the module from being installed. When you have made your selections, click on Next.

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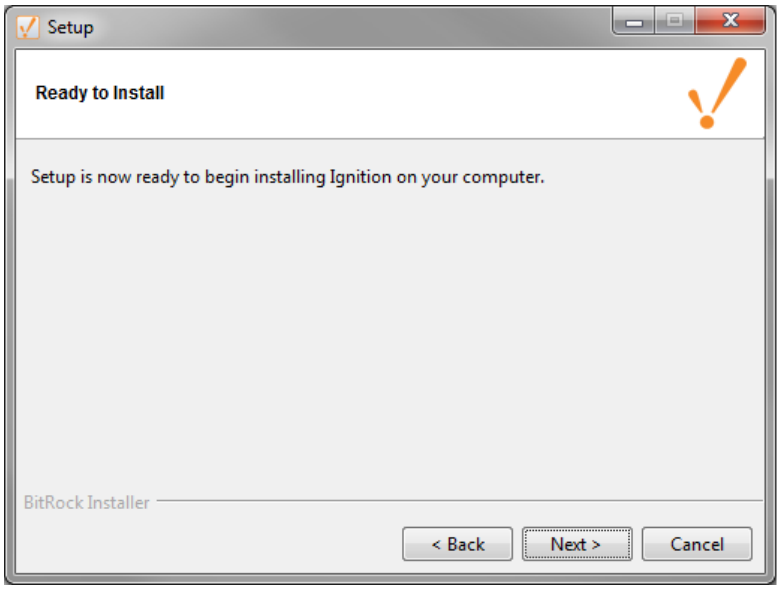
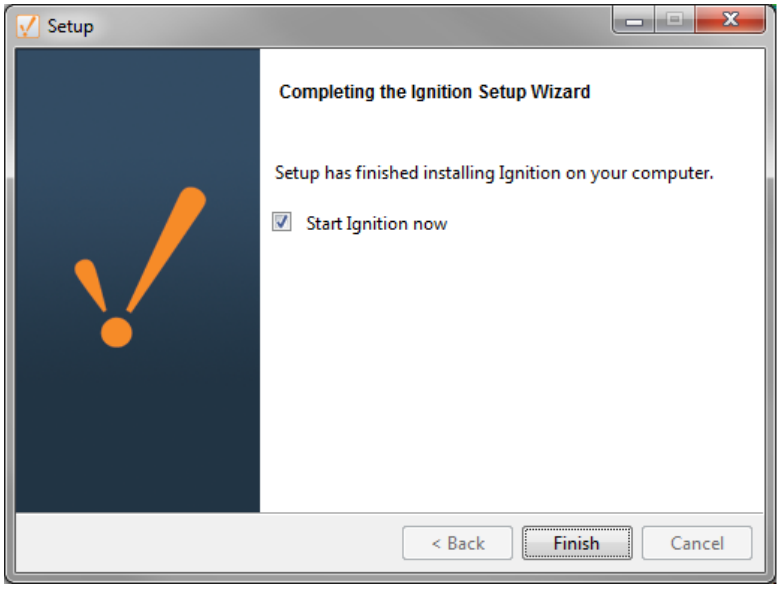


Ready to Install

Ignition is ready to be installed. At this point, you may click the Back button to change your selections. Click the Next button to finish the installation.

Once Ignition starts installing, it may take a few minutes to finish. Ignition installs itself as a Windows Service, so it will start automatically when your computer starts up.



Installation complete

When the installation is complete, press the "Finish" button. If you have chosen to start Ignition now, you will see a splash screen informing you that the Ignition service is starting.

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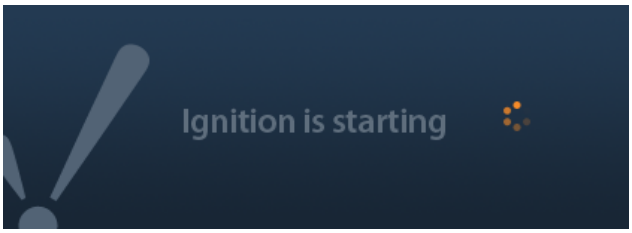

Ignition service starting up...

Once the Ignition Gateway starts up, your web browser will open and bring you to the Gateway Homepage.

Automated installation

Ignition can be silently installed from a command shell without showing any user prompts. This allows you to automate Ignition installation across different machines using scripts. Keep in mind that the installer cannot automatically start the Gateway after a silent installation. Use the `net start ignition` command as shown below.

Command line example:

```
Ignition-7.x.x-windows-x64-installer.exe --mode unattended --prefix "C:\some folder"
--unattendedmodeui none

net start ignition
```

Flags:
`-- mode unattended` (ensures that no prompts appear during installation)
`-- prefix "C:\some folder"` (optional flag; if a value is set, then Ignition will be installed in the specified folder, otherwise Ignition will be installed in a default location under C:\Program Files)
`-- unattendedmodeui none | minimal` (the 'none' flag will not display any sort of graphic during installation; the 'minimal' flag will display a small progress bar and nothing else)

8.2 Installation (Linux)

Ignition comes with Linux executable installers that can be run under any Linux distribution. The installers are capable of running in graphical mode or in command line mode, allowing you to install Ignition on a headless Linux server. To install under a Linux OS, it is assumed that you are comfortable operating a shell.

The installer will install files in the following locations:
/usr/local/bin/ignition (unless a different installation directory was used)- contains binaries, startup scripts and the uninstall executable
/var/lib/ignition/data - contains application-generated files, temporary files and the internal database
/var/lib/ignition/user-lib - contains modules and JDBC jars
/var/log/ignition - contains the wrapper.log and other log files
/etc/ignition - contains configuration files. Symbolic links to these files are created in `/var/lib/ignition/data`.

The first step is to download the Ignition Linux executable installer from our website. Be sure to download the 32-bit installer for a 32-bit Linux installation, and the 64-bit installer for a 64-bit Linux

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installation. A 32-bit installer will not launch in a 64-bit system and vice versa. After downloading the installer, follow the directions below to install Ignition as a Linux service. You'll also find these directions in the distribution file's README, available in `/usr/local/bin/ignition` after installation.

You need to be able to run as ROOT (prefix everything with 'sudo', run 'sudo su', or login as `root` user).

1. **Install Java 6 (if not already installed)**
   Non-Ubuntu users: you should install Java using your package management utility (such as *yum* for Fedora-based systems). If you cannot install Java using a package management utility, you can unzip the Java executables to a folder and give the location to that folder during Ignition installation. Note that when you unzip the Java executables to a folder, you will also need to add the executables to the system PATH.

   Ubuntu users: at the command line, run `sudo apt-get install sun-java6-jre`

   If apt returns an error that sun-java6-jre is not available, then you must follow these steps to add the java 6 repository:

   Graphical mode:
   At the command line, start the Software Sources tool:
   ```
   sudo software-properties-gtk
   ```

   Within the tool, click on the Other Software tab and click on the Add button.

   Add this to the APT line textbox:
   ```
   deb http://archive.canonical.com/ubuntu maverick partner
   ```

   Click the Add Source button. Then click on Close. When prompted, allow updated lists to reload.

   From a command shell, run
   ```
   sudo apt-get install sun-java6-jre
   ```

   Command line mode:
   Copy **/etc/apt/sources.list** to **/etc/apt/sources.list.bak**

   Edit **/etc/apt/sources.list** and add this line:
   ```
   deb http://archive.canonical.com/ubuntu maverick partner
   ```

   To update the download list, run
   ```
   sudo apt-get update
   ```

   Finally, run:
   ```
   sudo apt-get install sun-java6-jre
   ```

2. **Open a command shell and navigate to the installer executable.**

   On the command line, run:
   ```
   chmod +x ignition_X.X.X-installer.run
   ```

3. **Start the installer executable**
   If you are running the installer in a shell in a graphical environment, the graphical installer will open automatically. If you are running the installer in a headless Linux installation, or through a SSH shell,

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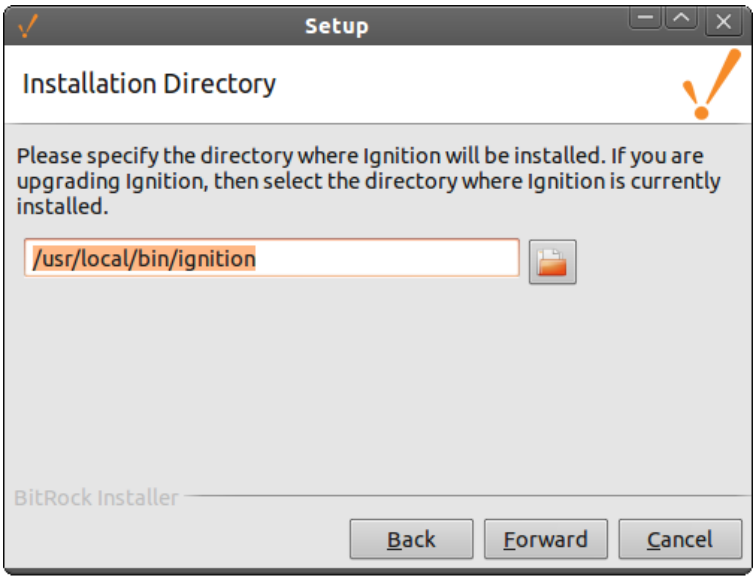
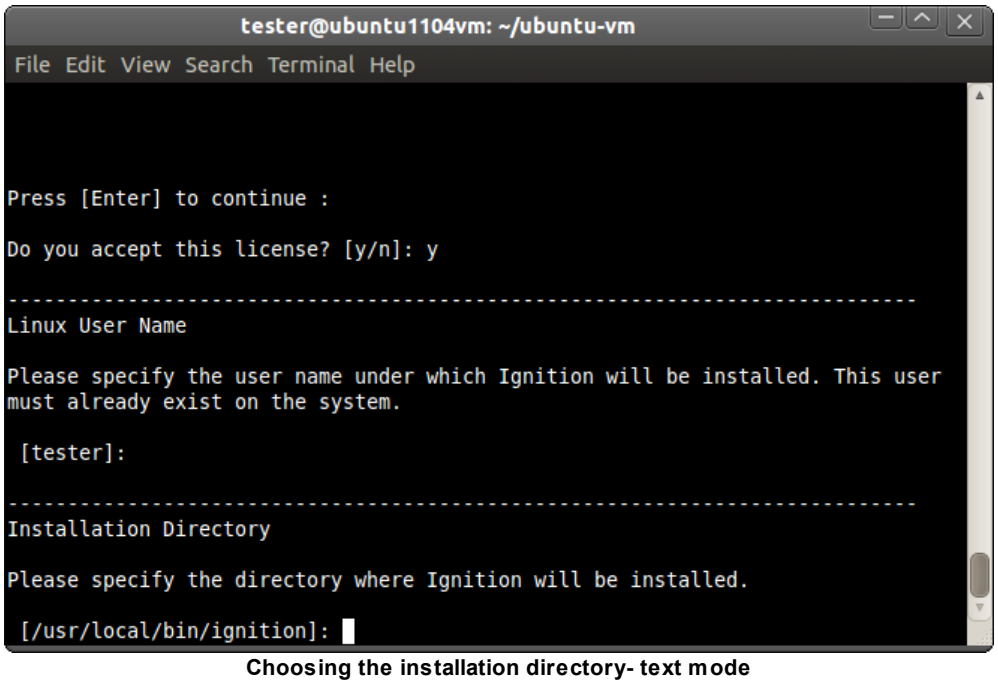
the text installer will open automatically. Want to run the text installer in a graphical environment? Add `--mode text` to the end of the command below.

On the command line, run:
`./ignition_X.X.X-installer.run`

After the installer starts, if you agree to the licensing terms, continue on to the next step.


Setup
Installation Directory
Please specify the directory where Ignition will be installed. If you are upgrading Ignition, then select the directory where Ignition is currently installed.
/usr/local/bin/ignition
BitRock Installer
Back
Forward
Cancel

Choosing the installation directory- graphical mode


tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Press [Enter] to continue :
Do you accept this license? [y/n]: y
Linux User Name
Please specify the user name under which Ignition will be installed. This user must already exist on the system.
[tester]:
Installation Directory
Please specify the directory where Ignition will be installed.
[/usr/local/bin/ignition]:

Choosing the installation directory- text mode

This section allows you to change the installation location. Use the default value of `/user/local/bin/ignition` unless you have a need to use a different folder. After you have selected your installation directory, continue on to the next step.

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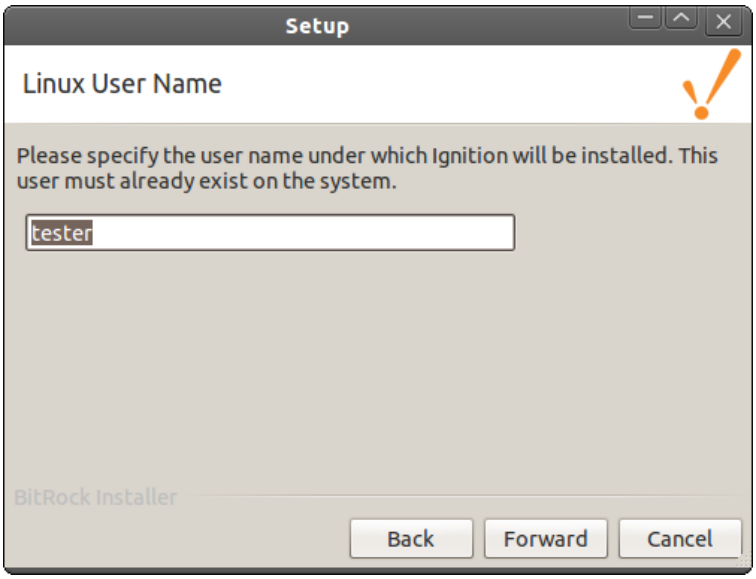
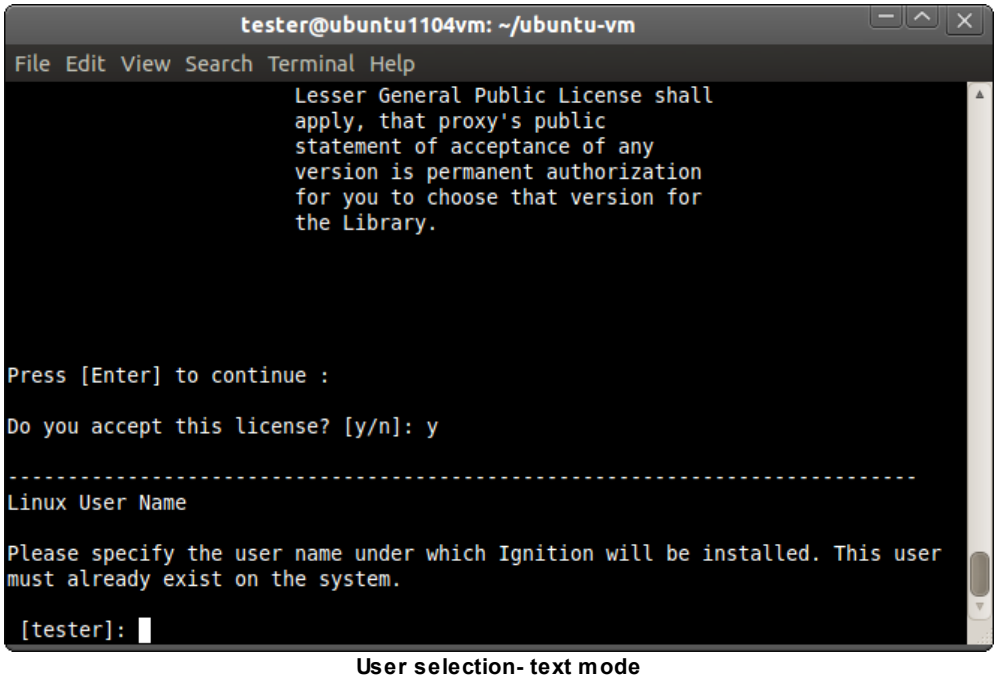


User selection- graphical mode


tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Lesser General Public License shall
apply, that proxy's public
statement of acceptance of any
version is permanent authorization
for you to choose that version for
the Library.
Press [Enter] to continue :
Do you accept this license? [y/n]: y
Linux User Name
Please specify the user name under which Ignition will be installed. This user must already exist on the system.
[tester]:

User selection- text mode

In order to set the permissions on the folders created by the installer, the Linux installer requires a user name. This user will be able to start and stop Ignition and run the Gateway Control Utility and command line interfaces. The binaries in the installation folder are still owned by root and cannot be modified without root access. The selected user must already exist on the system before starting the installer. For Ubuntu installations, the user that invoked sudo is used by default. For other Linux installations, this field is initially blank. After you have entered the user, continue on to the next step.

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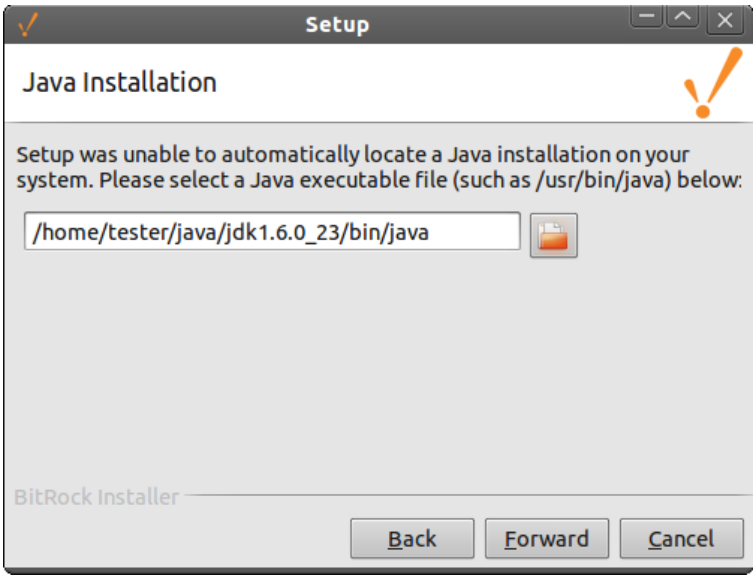
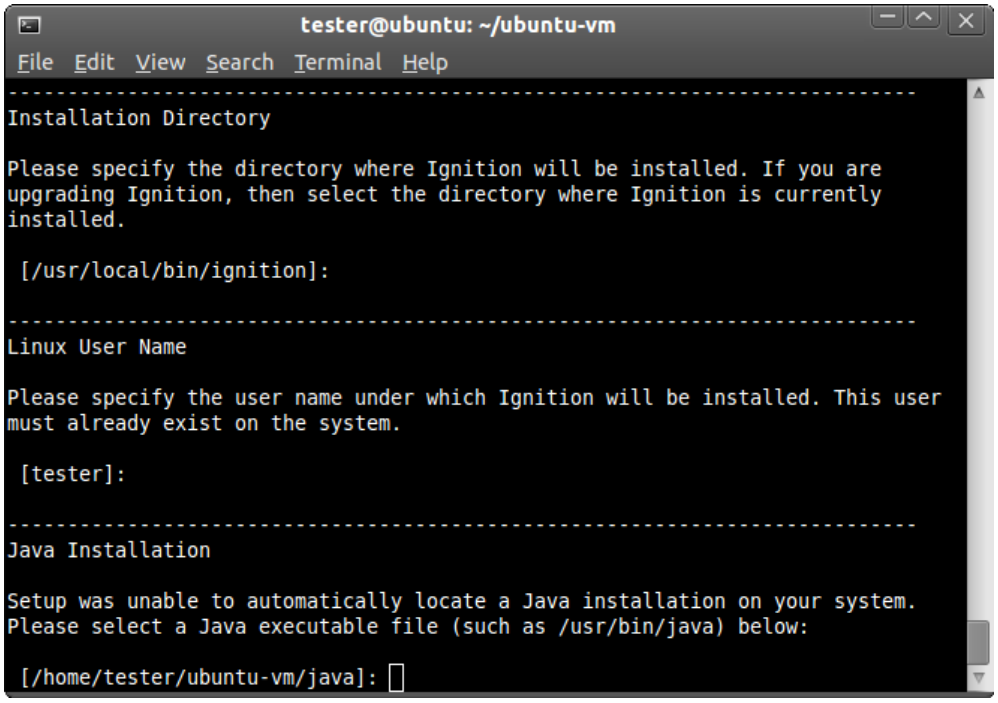


Selecting an existing Java installation- graphical mode


tester@ubuntu: ~/ubuntu-vm
File Edit View Search Terminal Help
Installation Directory
Please specify the directory where Ignition will be installed. If you are upgrading Ignition, then select the directory where Ignition is currently installed.
[/usr/local/bin/ignition]:
Linux User Name
Please specify the user name under which Ignition will be installed. This user must already exist on the system.
[tester]:
Java Installation
Setup was unable to automatically locate a Java installation on your system.
Please select a Java executable file (such as /usr/bin/java) below:
[/home/tester/ubuntu-vm/java]:

Selecting an existing Java installation- text mode

Normally, the installer is capable of auto-detecting a Java 6 installation that has been installed thru APT or some other Linux package management tool. In these cases, the installer will use that Java installation and skip past this step. However, if you have installed Java by extracting the Java binaries to a folder and adding them to the system PATH, the installer will be unable to find the Java binaries. In this case, you must provide the installer with a full path to the Java executable.

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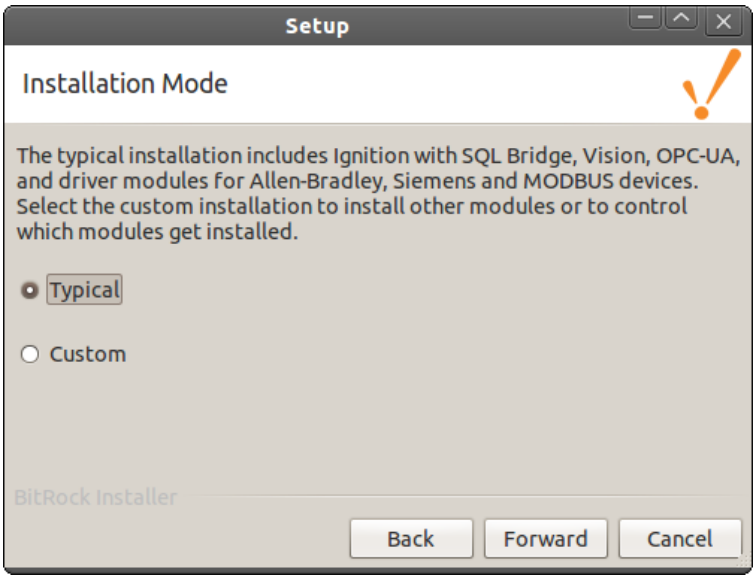
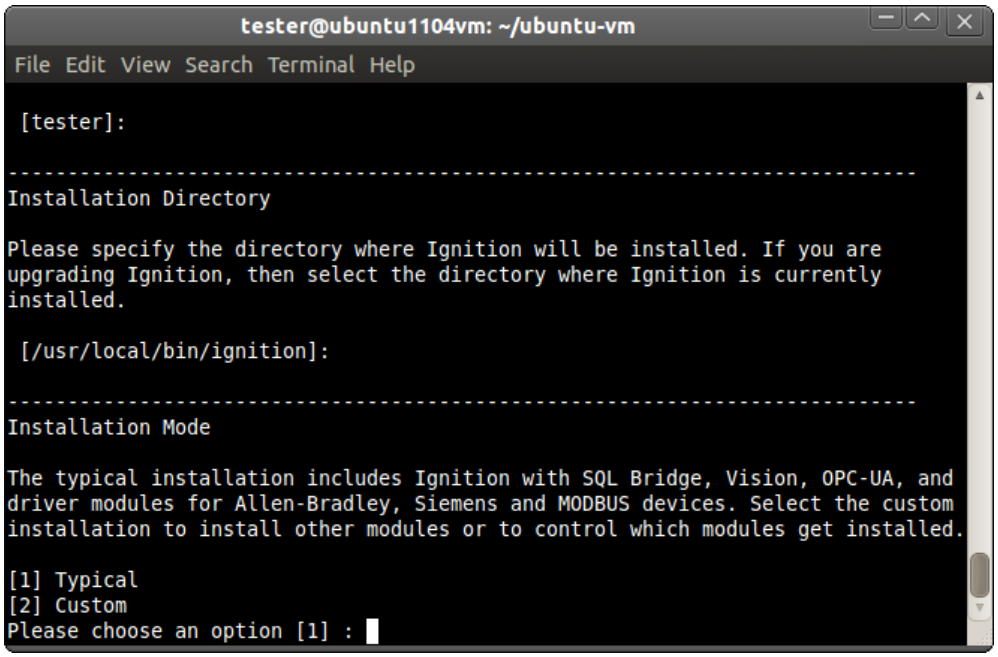

Setup
Installation Mode
The typical installation includes Ignition with SQL Bridge, Vision, OPC-UA, and driver modules for Allen-Bradley, Siemens and MODBUS devices. Select the custom installation to install other modules or to control which modules get installed.
Typical
Custom
BitRock Installer
Back
Forward
Cancel

Choosing the Installation Mode- graphical mode


tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
[tester]:
Installation Directory
Please specify the directory where Ignition will be installed. If you are upgrading Ignition, then select the directory where Ignition is currently installed.
[/usr/local/bin/ignition]:
Installation Mode
The typical installation includes Ignition with SQL Bridge, Vision, OPC-UA, and driver modules for Allen-Bradley, Siemens and MODBUS devices. Select the custom installation to install other modules or to control which modules get installed.
[1] Typical
[2] Custom
Please choose an option [1] :

Choosing the Installation Mode- text mode

The next option in the installer is to choose the installation mode. For most scenarios, the Typical mode will install everything that you need to get started. If you would like to add an optional module, such as the OEE Downtime module, select the Custom mode. You can also use the Custom mode to control which modules get installed. When you have made your selection, continue on to the next step.

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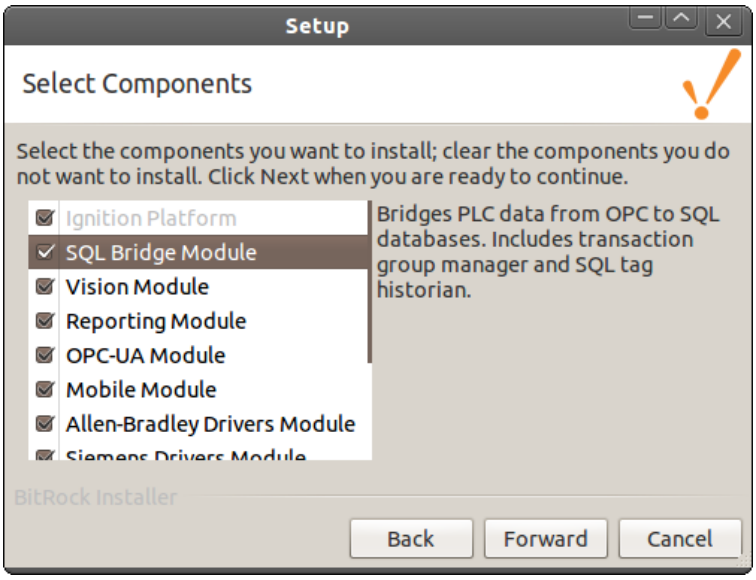
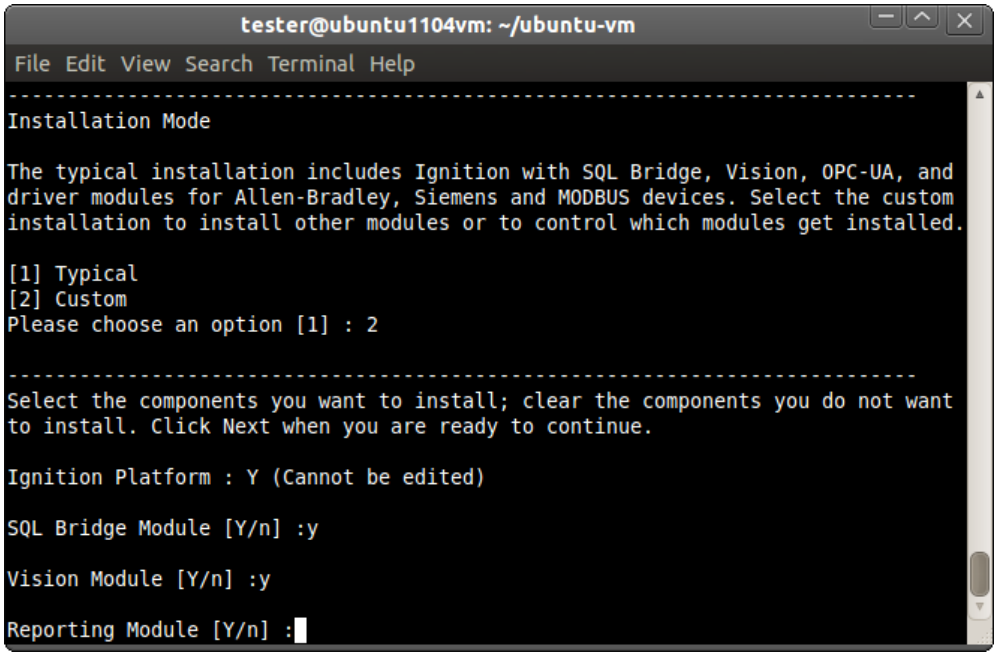

Setup
Select Components
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Ignition Platform
SQL Bridge Module
Vision Module
Reporting Module
OPC-UA Module
Mobile Module
Allen-Bradley Drivers Module
Bridges PLC data from OPC to SQL databases. Includes transaction group manager and SQL tag historian.
BitRock Installer
Back
Forward
Cancel

Custom Mode Module Selection- graphical mode


tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Installation Mode
The typical installation includes Ignition with SQL Bridge, Vision, OPC-UA, and driver modules for Allen-Bradley, Siemens and MODBUS devices. Select the custom installation to install other modules or to control which modules get installed.
[1] Typical
[2] Custom
Please choose an option [1] : 2
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Ignition Platform : Y (Cannot be edited)
SQL Bridge Module [Y/n] :y
Vision Module [Y/n] :y
Reporting Module [Y/n] :

Custom Mode Module Selection- text mode

If you have selected Custom Mode, you will be presented with the screen above. Graphical mode- to view a brief description of the module, click on the module name. Checking the checkbox next to a module will install the module as part of the Ignition installation. Clearing the checkbox next to a module will prevent the module from being installed. Text mode- you will be presented with a list of all the modules, one at a time. Type "y" to install the module, and type "n" to prevent the module from being installed. When you have made your selections, continue on to the next step.

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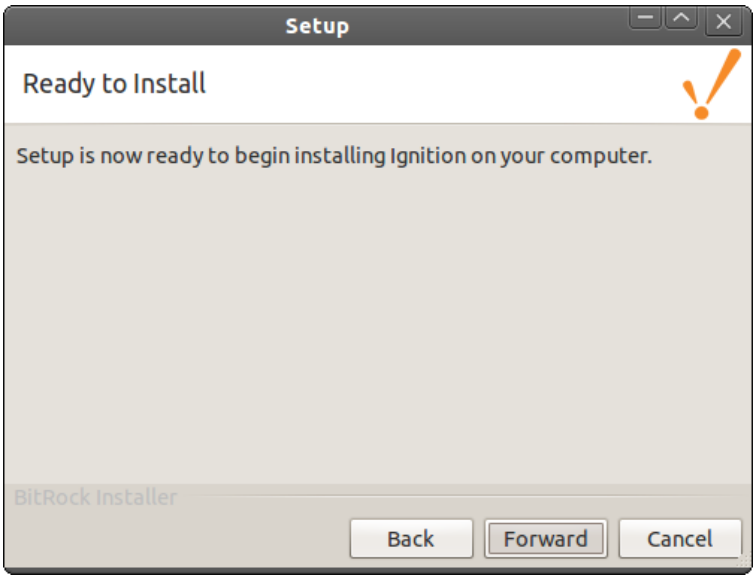
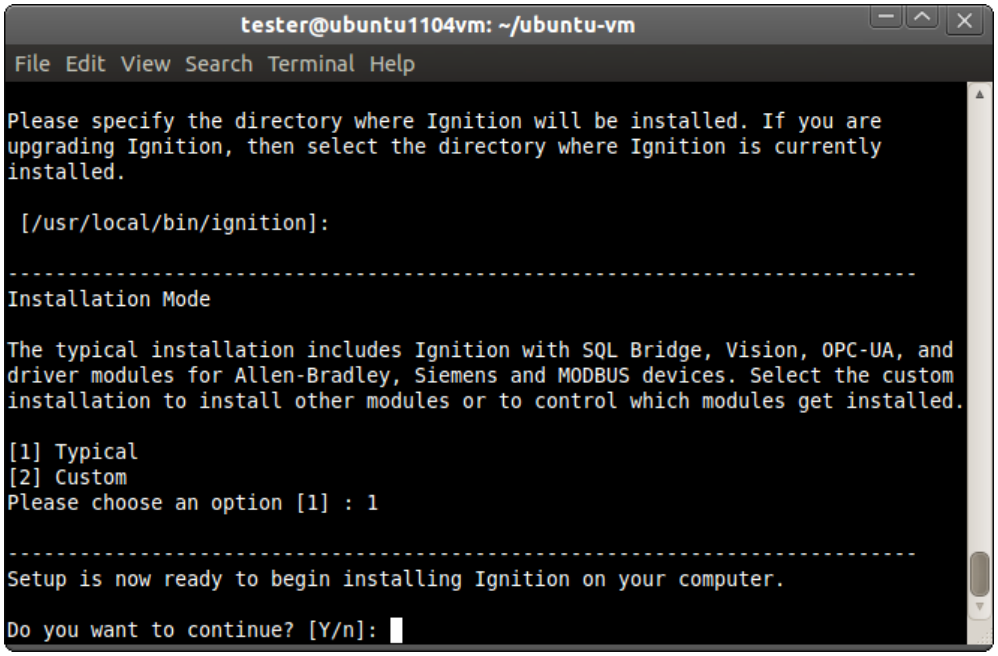


Ready to Install- graphical mode


tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Please specify the directory where Ignition will be installed. If you are upgrading Ignition, then select the directory where Ignition is currently installed.
[/usr/local/bin/ignition]:
Installation Mode
The typical installation includes Ignition with SQL Bridge, Vision, OPC-UA, and driver modules for Allen-Bradley, Siemens and MODBUS devices. Select the custom installation to install other modules or to control which modules get installed.
[1] Typical
[2] Custom
Please choose an option [1] : 1
Setup is now ready to begin installing Ignition on your computer.
Do you want to continue? [Y/n]:

Ready to Install- text mode

Ignition is ready to be installed. At this point, you may click the Back button (graphical mode) to change your selections. For the text mode, you can only abort the installation at this point by typing "n". Click the Next button (graphical mode) or type "y" (text mode) to finish the installation.

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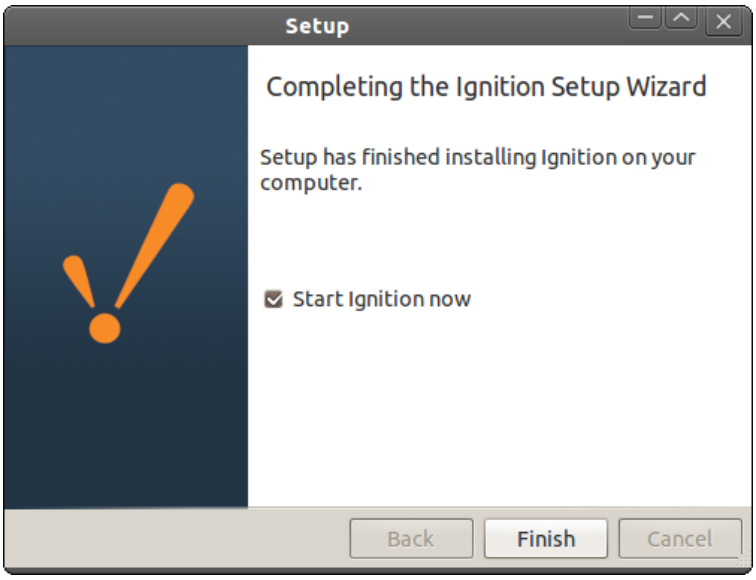
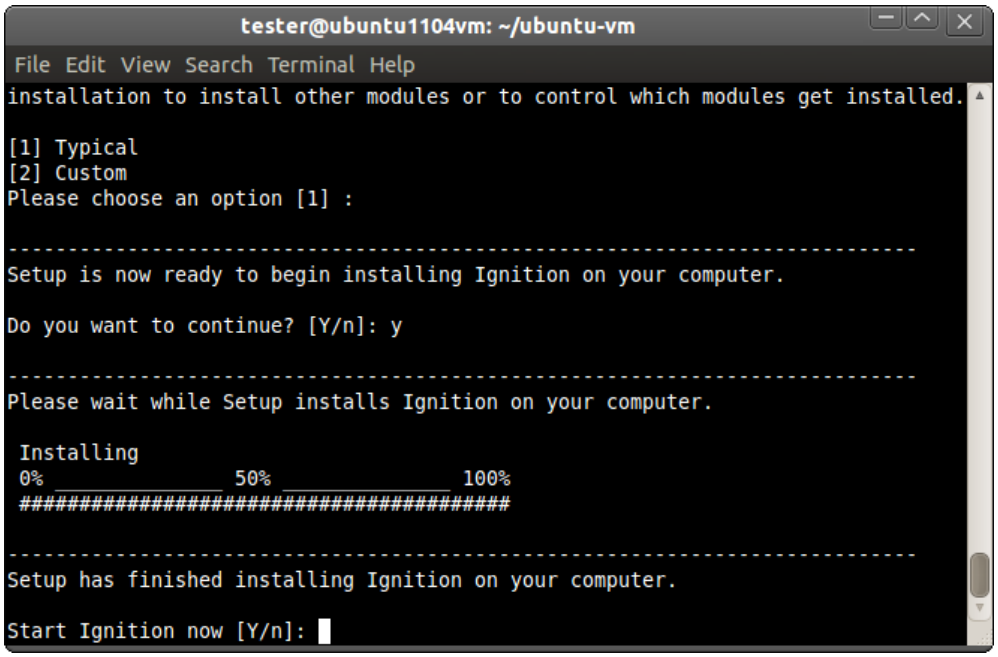


Installation complete- graphical mode


tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
installation to install other modules or to control which modules get installed.
[1] Typical
[2] Custom
Please choose an option [1] :
Setup is now ready to begin installing Ignition on your computer.
Do you want to continue? [Y/n]: y
Please wait while Setup installs Ignition on your computer.
Installing
0% 50% 100%
Setup has finished installing Ignition on your computer.
Start Ignition now [Y/n]:

Installation complete- text mode

When the installation is complete, press the "Finish" button (graphical mode) or type "y" to start Ignition or "n" to simply exit (text mode). If you have chosen to start Ignition now, then Ignition will be started as a background process. Use a web browser to navigate to `http://localhost:8088` to confirm that your Gateway is running.

4. **Stopping and starting Ignition**
   After installation, you can start and stop Ignition with the following commands:

```
/etc/init.d/ignition start
/etc/init.d/ignition stop
```

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5. **Ignition as a service**
   When installing under Ubuntu, Ignition will start automatically whenever the computer reboots. If you wish to stop this behaviour then you need to use the update-rc.d tool to remove the service (uninstalling Ignition also removes the service).

   ```
   /etc/init.d/ignition stop
   update-rc.d -f ignition remove
   rm /etc/init.d/ignition
   ```

   When installing under other Linux distributions, you will need to use that distribution's method to automatically start a program after reboot.
   For example, this command will autostart Ignition installed in a Fedora 15 system (run as root user):

   ```
   chkconfig --level 2345 ignition on
   ```

6. **Setting the system PATH**
   For Ubuntu installations, the installation directory is automatically appended to the system PATH. This allows you to start programs like the Gateway Control Utility from the command line without specifying a complete path to the installation directory. Note that after installation, you need to close and reopen the command shell for the PATH change to take effect. For other Linux installations, you will need to manually add `/usr/local/bin/ignition` (or your installation directory) to any script that can set the system PATH (such as .profile or .bashrc).

Automated installation

Ignition can be silently installed from a command shell without showing any user prompts. This allows you to automate Ignition installation across different machines using scripts. Keep in mind that the installer cannot automatically start the Gateway after a silent installation. Use the `/etc/init.d/ignition start` command as shown below.

Command line example:

```
sudo ./ignition-7.x.x-linux-x64-installer.run --mode unattended --prefix /somefolder/bin/ignition --unattendedmodeui none

/etc/init.d/ignition start
```

Flags:
`-- mode unattended` (ensures that no prompts appear during installation)
`-- prefix /somefolder/bin/ignition` (optional flag; if a value is set, then Ignition will be installed in the specified folder, otherwise Ignition will be installed in `/usr/local/bin/ignition` by default)
`-- serviceuser username` (allows a Linux system user to be installed (i.e., a user that cannot log in to the OS))
`-- unattendedmodeui none | minimal` (the 'none' flag will not display any sort of graphic during installation; the 'minimal' flag will display a small progress bar and nothing else, but only if you are working in a graphical system)

8.3 Installation (Debian Package Management)

Ignition can be quickly installed using the package management tools installed on Ubuntu and other Debian-based systems. Debian package management is a powerful way to quickly install Linux programs and keep them up to date with minimal effort. Note that you need to be able to run as sudo to

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be able to install Ignition. Also, the machine where you would like to install Ignition must be connected to the Internet so that the installer and updates can be installed automatically. If you are installing Ignition to a non Internet-connected machine, use the downloadable Linux installers instead (see the Installation (Linux) section for more details).

The Ignition Debian installers are dependent on an existing Java 6 installation through APT. Only the Sun Java 6 Java Runtime Environment (JRE) is officially supported by Inductive Automation, although Ignition will likely run with any Java 6 JRE installed on the Linux system. See the first part of the Installation (Linux) section for instructions on how to install Java using APT.

The installer will install files in the following locations:
/usr/local/bin/ignition - contains binaries and startup scripts
/var/lib/ignition/data - contains application-generated files, temporary files and the internal database
/var/lib/ignition/user-lib - contains modules and JDBC jars
/var/log/ignition - contains the wrapper.log and other log files
/etc/ignition - contains configuration files. Symbolic links to these files are created in `/var/lib/ignition/data`.

When installing Ignition, you can choose whether to use the graphical package management tools, or install completely from the command line. With either option, Linux will automatically download the correct 32-bit or 64-bit installer depending on your installed system architecture. Note that the instructions below were written for an Ubuntu Linux system, but other Debian systems should still contain the same tools (although they may be under different menus).

Graphical installation:

1. Download the Inductive Automation public key file from **http://archive.inductiveautomation.com/ia.public.key** or run **`wget http://archive.inductiveautomation.com/ia.public.key`** on the command line.
2. Within Ubuntu, navigate to System -> Administration -> Synaptic Package Manager.
3. Within Synaptic Package Manager, navigate to Settings -> Repositories.
4. Navigate to the Authentication tab. Click on "Import Key File" and select the downloaded ia.public.key file.
5. Navigate to the Other Software tab and click on the "Add" button. Add the following text to the textbox:

   ```
   deb http://archive.inductiveautomation.com/apt ignition non-free
   ```

6. If you would like to add the Ignition beta repository, click the "Add" button again and add this text to the textbox:

   ```
   deb http://archive.inductiveautomation.com/apt ignition-beta non-free
   ```

7. Be sure to uncheck the checkboxes next to repositories ending with "Source Code", as Ignition does not supply source code with the repositories.
8. Click the Close button. Within Synaptic Package Manager, click the Reload button. You can now type in "ignition" into the Quick Filter box and see the latest available Ignition repositories.

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9. Right-click on the Ignition repository that you would like to install, and select "Mark for Installation". Then click the Apply button at the top. Ignition will be automatically downloaded and started. Navigate to http://localhost:8088 to log into the Ignition gateway.

Command line installation:

1. Run `wget http://archive.inductiveautomation.com/ia.public.key`
2. Run `sudo apt-key add ia.public.key`
3. Copy /etc/apt/sources.list to /etc/apt/sources.list.bak
4. Edit /etc/apt/sources.list and add these lines (the ignition-beta line is optional):

```
deb http://archive.inductiveautomation.com/apt ignition non-free
deb http://archive.inductiveautomation.com/apt ignition-beta non-free
```

5. Run `sudo apt-get update` to update the download list within the APT utility.
6. Run `sudo apt-get install ignition` to install the latest stable Ignition version or run `sudo apt-get install ignition-beta` to install the latest beta Ignition version.

If you would like to run the Gateway Command Utility or gwcmd right after installation, open a command shell in your home folder and run **`source .profile`**. This will force your command shell to reload the .profile script, which has been updated with a path to the Ignition executable during installation.

Upgrades

During an upgrade, the Ignition internal database, configuration files, and any custom installed modules will not be changed. Whenever a new version of Ignition is released, the online Debian repositories also get updated with the latest version. Your Linux environment will list Ignition in the list of package upgrades when a new version is available. As with the installation, you can choose whether to upgrade using a graphical environment or using the command line.

Graphical Upgrade:

Ignition will appear as an entry under your system's Update Manager under the "Other Updates" section. If you choose to install updates using the Update Manager, Ignition will be upgraded at the same time as other packages. You can also manually upgrade Ignition using Symantic Package Manager. Locate "ignition" or "ignition-beta" in the list using the Quick Filter. Ignition can also be found in the World Wide Web section. Right-click and select "Mark for Upgrade". Then click "Apply" at the top. The latest version of Ignition will be downloaded and installed.

Command line upgrade:

Run **`sudo apt-get upgrade`** to upgrade all installed packages, including Ignition. To only upgrade Ignition, run **`sudo apt-get install ignition`** or **`sudo apt-get install ignition-beta`**. The APT utility will recognize that Ignition is already installed, and will perform the upgrade.

8.4 Upgrade (Windows)

The Ignition upgrade process is designed to be as painless as possible. Before performing any upgrade, you should back up your gateway (see Backups). The Ignition installer also doubles as an upgrader. Simply download the Windows executable installer from our website, and double-click on it. Be sure to download the 32-bit installer for a 32-bit Windows installation, and the 64-bit installer for a 64-bit Windows installation. If you attempt to upgrade a 32-bit installation with a 64-bit installer, or vice versa,

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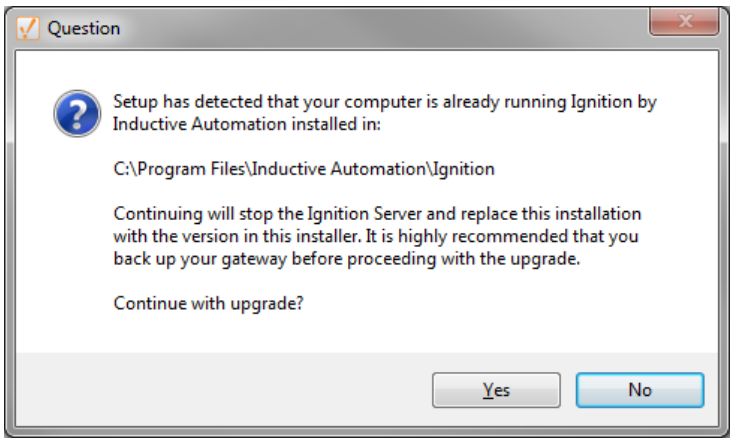
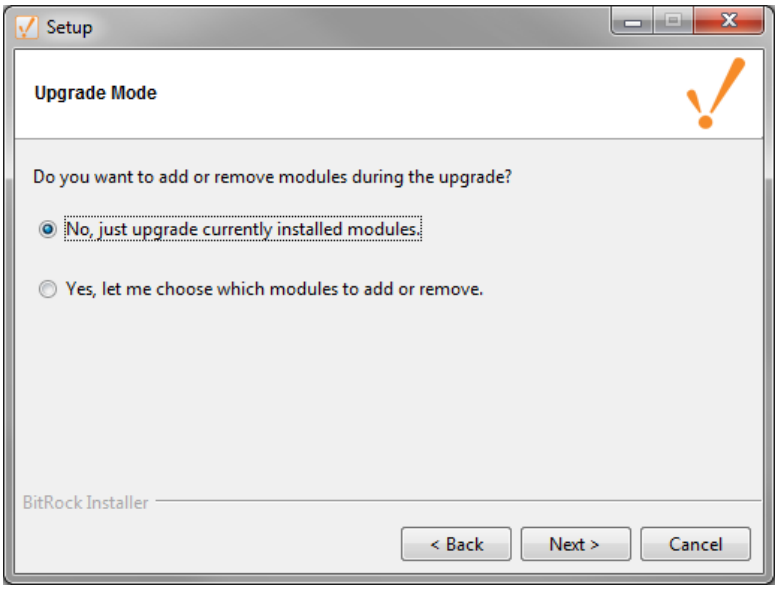
the installer will throw an error. After double-clicking on the executable installer, you will be presented with this screen:


Question
Setup has detected that your computer is already running Ignition by Inductive Automation installed in:
C:\Program Files\Inductive Automation\Ignition
Continuing will stop the Ignition Server and replace this installation with the version in this installer. It is highly recommended that you back up your gateway before proceeding with the upgrade.
Continue with upgrade?
Yes
No

Upgrade confirmation

Click Yes to start the upgrade process. The first stage of this process will be to stop the Ignition Windows service on the machine. If you abort the upgrade process before it completes, the installer will attempt to restart your old Ignition Windows service. After accepting the license agreement, you will be presented with the Upgrade Mode screen.


Setup
Upgrade Mode
Do you want to add or remove modules during the upgrade?
No, just upgrade currently installed modules.
Yes, let me choose which modules to add or remove.
BitRock Installer
< Back
Next >
Cancel

Choosing the Upgrade Mode

For most scenarios, choosing to just upgrade currently installed modules will be sufficient, as it will upgrade the Ignition base installation and the existing modules. Choosing "Yes" will take you to the module selection screen on the next page, where you can add a module that was not part of the original installation or uninstall a currently installed module. When you have made your selection, click on Next.

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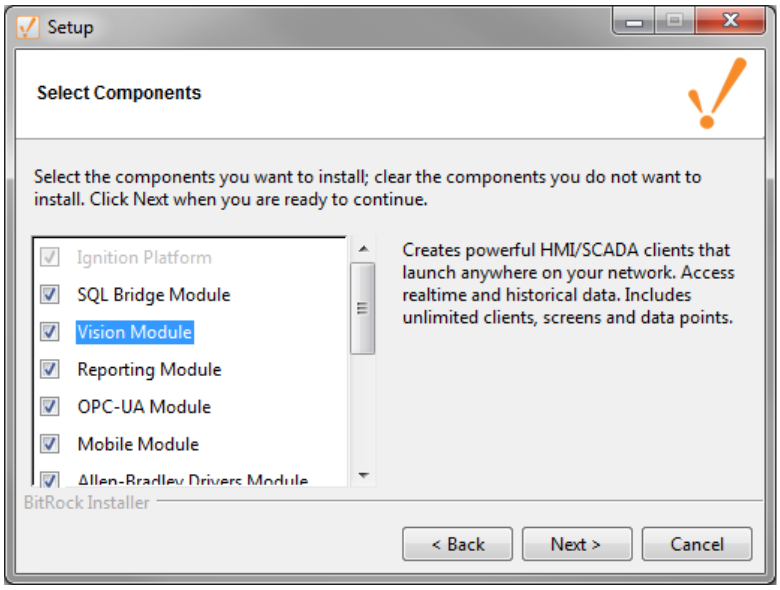
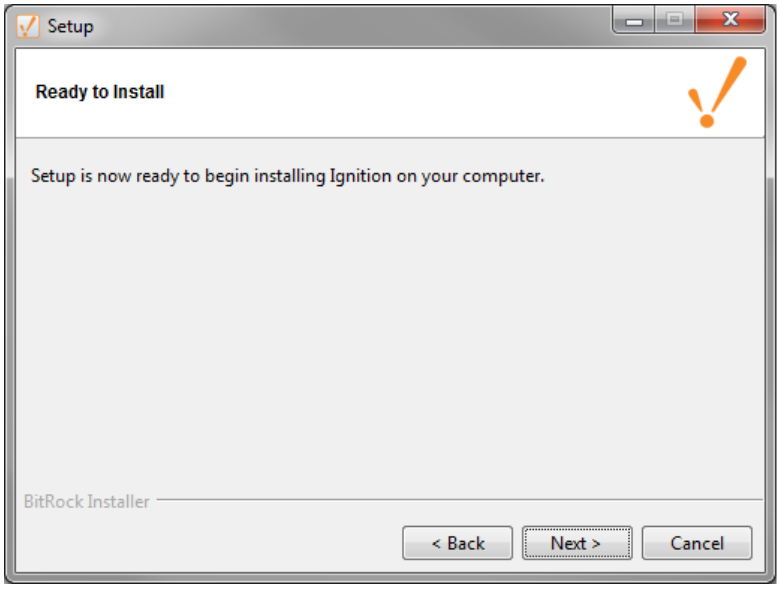

Setup
Select Components
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Ignition Platform
SQL Bridge Module
Vision Module
Reporting Module
OPC-UA Module
Mobile Module
Allen-Bradley Drivers Module
Creates powerful HMI/SCADA clients that launch anywhere on your network. Access realtime and historical data. Includes unlimited clients, screens and data points.
BitRock Installer
< Back
Next >
Cancel

Selecting modules to add or remove

If you have chose to select which modules to add or remove on the previous screen, you will be presented with the screen above. To view a brief description of the module, click on the module name. Checking the checkbox next to a module will install the module as part of the upgrade. Clearing the checkbox next to a module will uninstall the module during the upgrade. When you have made your selections, click on Next.



Ready to Install

Ignition is ready to be upgraded. At this point, you may click the Back button to change your selections. Click the Next button to finish the upgrade.

Once the upgrade process starts, it may take a few minutes to finish. At the end of the upgrade process, you will see the screen below.

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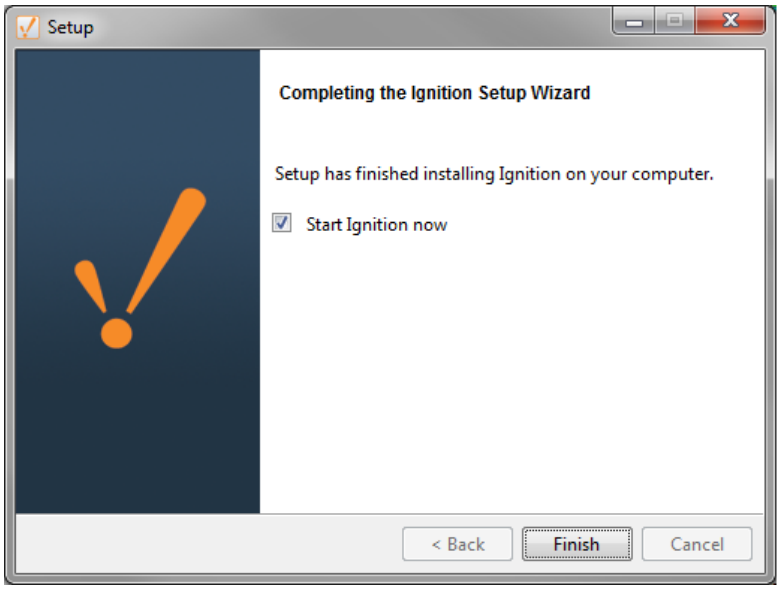
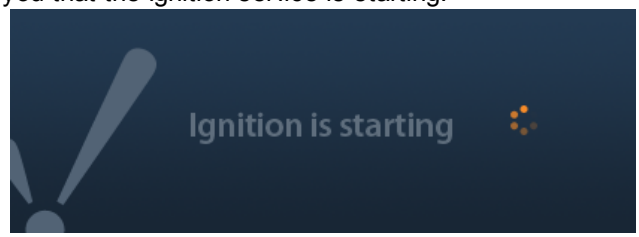


Upgrade complete

Press the "Finish" button to close the process. If you have chosen to start Ignition now, you will see a splash screen informing you that the Ignition service is starting.



Ignition service starting up...

Once the Ignition Gateway starts up, your web browser will open and bring you to the Gateway Homepage.

Automated upgrade

Ignition can be silently upgraded from a command shell without showing any user prompts. Keep in mind that you should make a Gateway backup before performing any type of upgrade. Also, the installer cannot automatically start the Gateway after a silent upgrade. Use the `net start ignition` command as shown below.

Command line example:

```
gwcmd -b C:\backups\mybackup.gwbk

Ignition-7.x.x-windows-x64-installer.exe --mode unattended --unattendedmodeui none --autoupgrade true

net start ignition
```

Flags:

`-- mode unattended` (ensures that no prompts appear during installation)

`-- unattendedmodeui none | minimal` (the 'none' flag will not display any sort of graphic during installation; the 'minimal' flag will display a small progress bar and nothing else)

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`-- autoupgrade true` (runs the installer in upgrade mode)

8.5 Upgrade (Linux)

Unlike some Linux operations, the Ignition Linux upgrade process is designed to be as painless as possible. Note that while Ignition is currently optimized for Ubuntu Linux, the upgrade process will work for any Linux distribution. Before performing any upgrade, you should back up your gateway (see Backups). The Ignition installer also doubles as an upgrader. Simply download the Linux executable installer from our website, and double-click on it. Be sure to download the 32-bit installer for a 32-bit Linux installation, and the 64-bit installer for a 64-bit Linux installation. A 32-bit installer will not launch in a 64-bit system and vice versa.

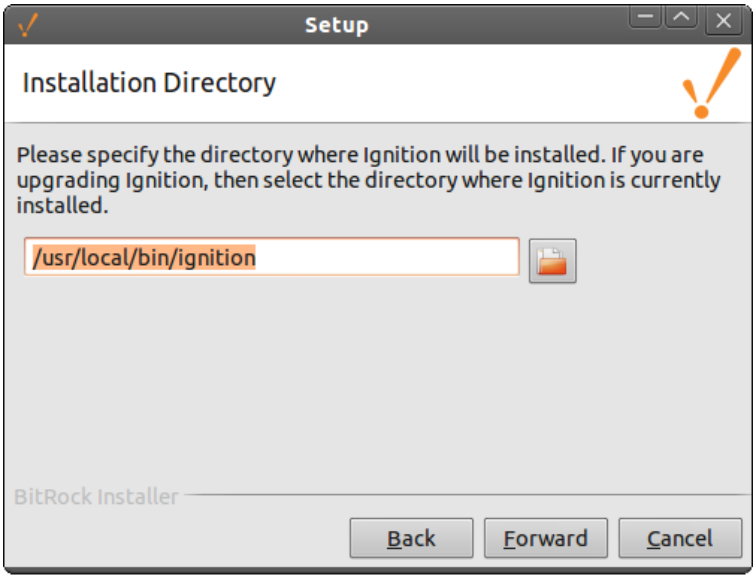
You need to be able to run as ROOT (prefix everything with 'sudo', run 'sudo su', or login as root user) to perform the upgrade.

After downloading the installer, open a command shell and navigate to the installer executable. Run:
`chmod 744 *`

Then run:
`./ignition_X.X.X-installer.run`

If you are running the installer in a shell in a graphical environment, the graphical installer will open automatically. If you are running the installer in a headless Linux installation, or through a SSH shell, the text installer will open automatically. Want to run the text installer in a graphical environment? Add `--mode text` to the end of the command above.

After the installer starts, if you agree to the licensing terms, continue on to the next step.


Setup
Installation Directory
Please specify the directory where Ignition will be installed. If you are upgrading Ignition, then select the directory where Ignition is currently installed.
/usr/local/bin/ignition
BitRock Installer
Back
Forward
Cancel

Choosing the installation directory- graphical mode

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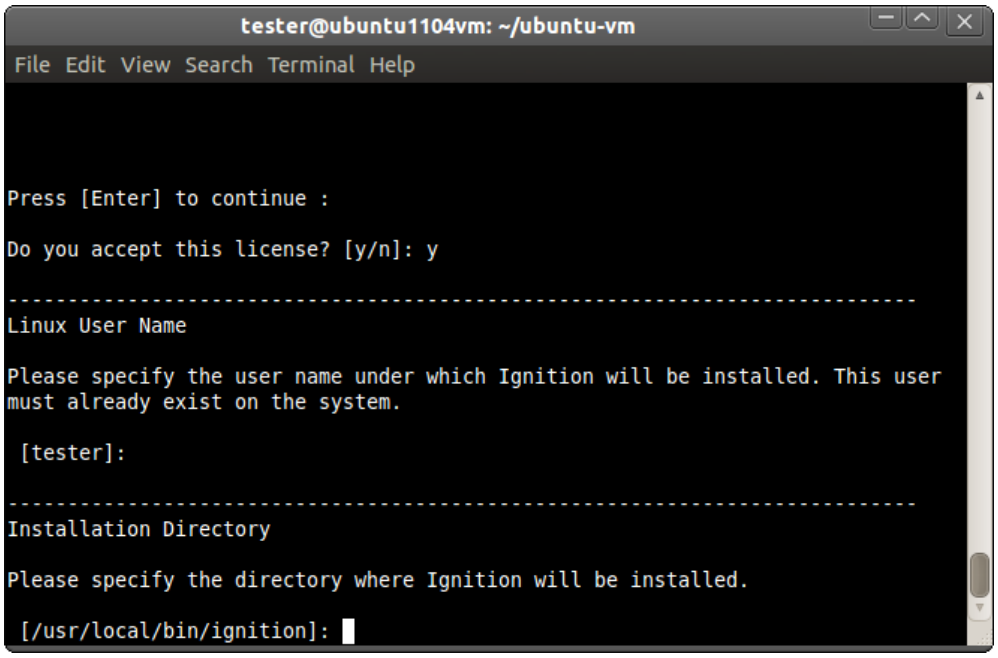
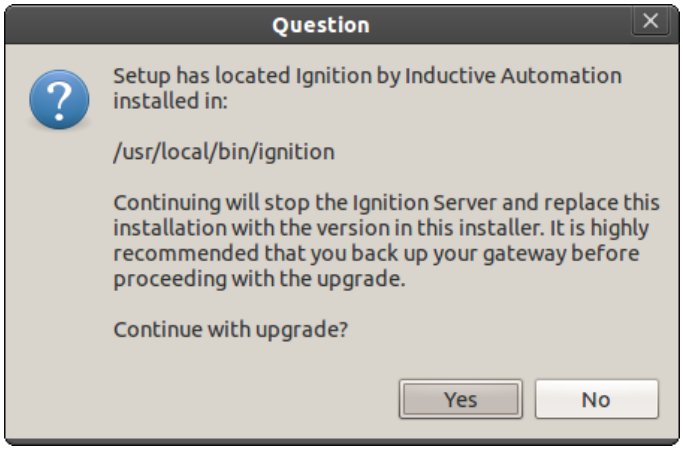

tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Press [Enter] to continue :
Do you accept this license? [y/n]: y
Linux User Name
Please specify the user name under which Ignition will be installed. This user must already exist on the system.
[tester]:
Installation Directory
Please specify the directory where Ignition will be installed.
[/usr/local/bin/ignition]:

Choosing the installation directory- text mode

Linux does not have the concept of a central registry like Windows systems do. Therefore, you must provide the location of the existing Ignition installation. By default, this value is `/usr/local/bin/ignition`, unless you have installed Ignition in another location. After you have selected your installation directory, continue on to the next step.


Question
Setup has located Ignition by Inductive Automation installed in:
/usr/local/bin/ignition
Continuing will stop the Ignition Server and replace this installation with the version in this installer. It is highly recommended that you back up your gateway before proceeding with the upgrade.
Continue with upgrade?
Yes
No

Upgrade confirmation- graphical mode

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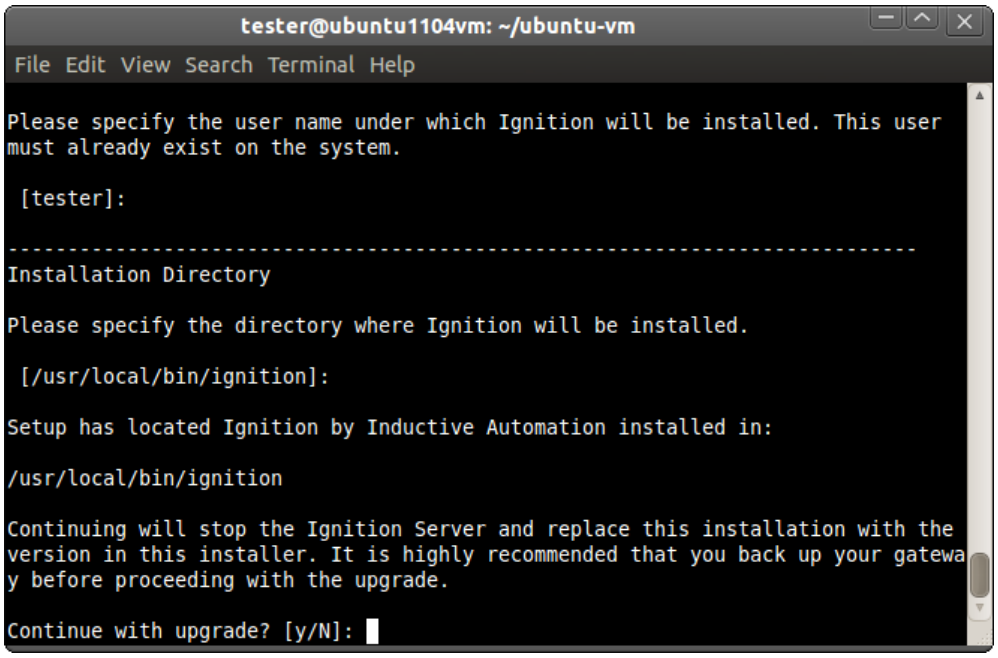
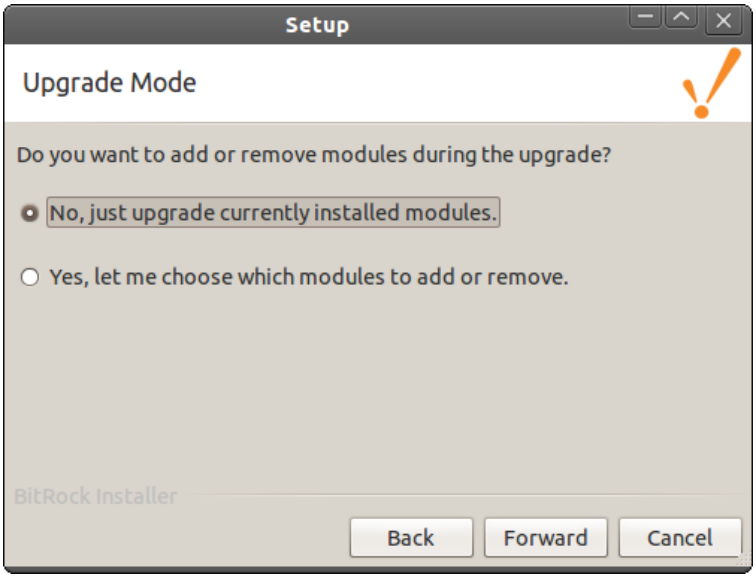

tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Please specify the user name under which Ignition will be installed. This user must already exist on the system.
[tester]:
Installation Directory
Please specify the directory where Ignition will be installed.
[/usr/local/bin/ignition]:
Setup has located Ignition by Inductive Automation installed in:
/usr/local/bin/ignition
Continuing will stop the Ignition Server and replace this installation with the version in this installer. It is highly recommended that you back up your gateway before proceeding with the upgrade.
Continue with upgrade? [y/N]:

Upgrade confirmation- text mode

If the upgrader is able to locate Ignition in the specified folder, you will presented with the screen above. Click Yes or type "y" to continue.

.



Selecting the Upgrade Mode- graphical mode

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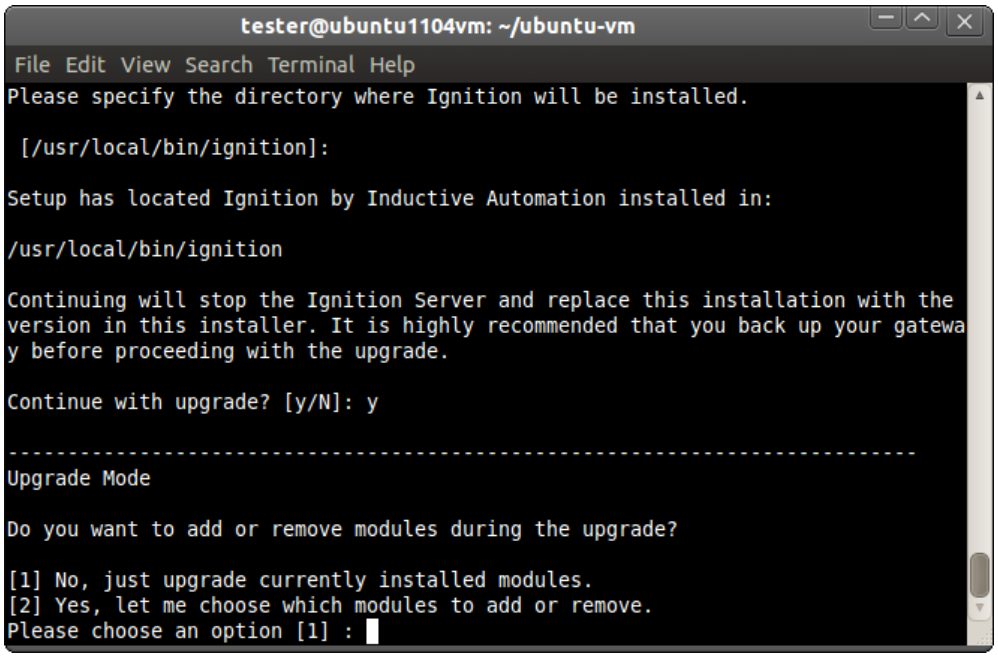
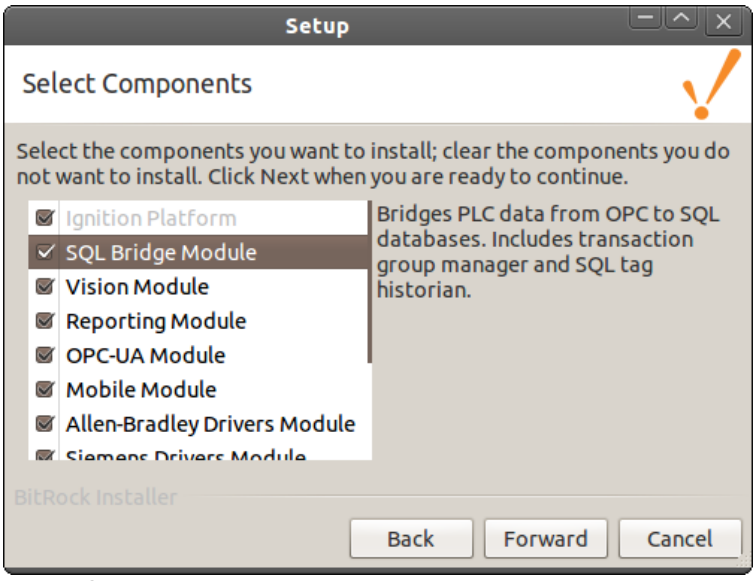

tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Please specify the directory where Ignition will be installed.
[/usr/local/bin/ignition]:
Setup has located Ignition by Inductive Automation installed in:
/usr/local/bin/ignition
Continuing will stop the Ignition Server and replace this installation with the version in this installer. It is highly recommended that you back up your gateway before proceeding with the upgrade.
Continue with upgrade? [y/N]: y
Upgrade Mode
Do you want to add or remove modules during the upgrade?
[1] No, just upgrade currently installed modules.
[2] Yes, let me choose which modules to add or remove.
Please choose an option [1] :

Selecting the Upgrade Mode- text mode

For most scenarios, choosing to just upgrade currently installed modules will be sufficient, as it will upgrade the Ignition base installation and the existing modules. Choosing "Yes" will take you to the module selection screen on the next page, where you can add a module that was not part of the original installation or uninstall a currently installed module. When you have made your selection, continue to the next section.


Setup
Select Components
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Ignition Platform
SQL Bridge Module
Vision Module
Reporting Module
OPC-UA Module
Mobile Module
Allen-Bradley Drivers Module
Bridges PLC data from OPC to SQL databases. Includes transaction group manager and SQL tag historian.
BitRock Installer
Back
Forward
Cancel

Selecting modules to add or remove- graphical mode

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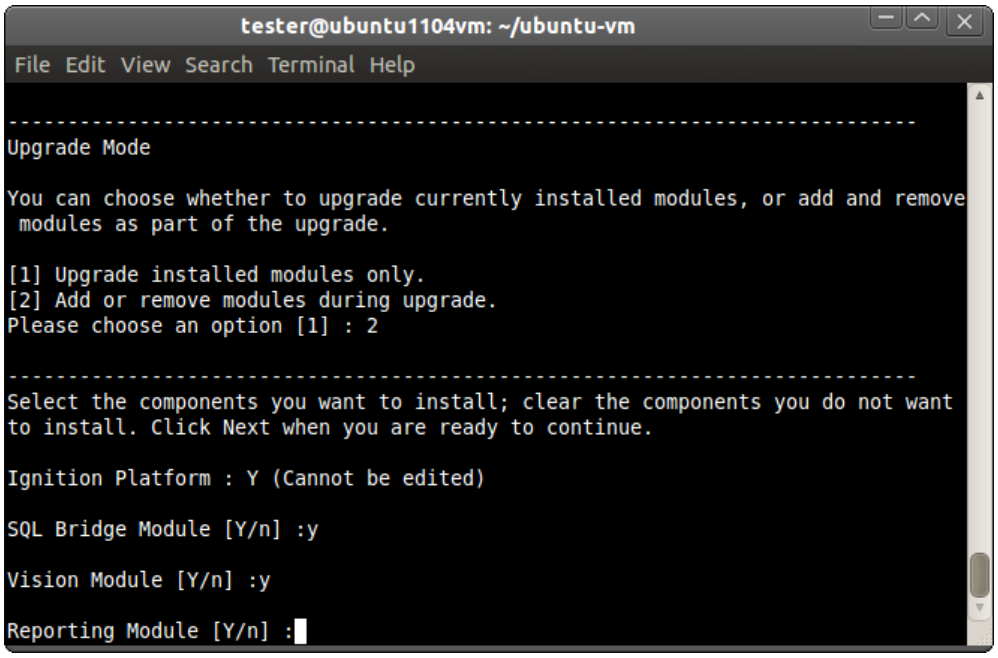
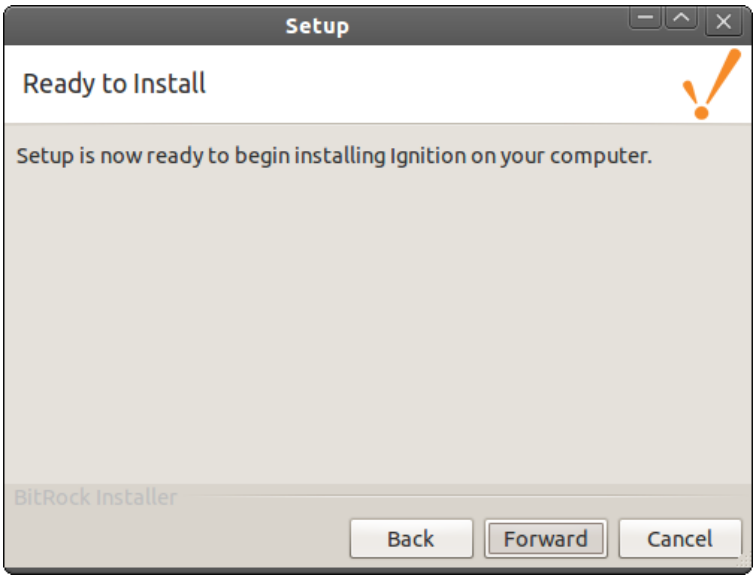

tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
Upgrade Mode
You can choose whether to upgrade currently installed modules, or add and remove modules as part of the upgrade.
[1] Upgrade installed modules only.
[2] Add or remove modules during upgrade.
Please choose an option [1] : 2
Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.
Ignition Platform : Y (Cannot be edited)
SQL Bridge Module [Y/n] :y
Vision Module [Y/n] :y
Reporting Module [Y/n] :

Selecting modules to add or remove- text mode

If you have chose to select which modules to add or remove on the previous screen, you will be presented with the screen above. Graphical mode-to view a brief description of the module, click on the module name. Checking the checkbox next to a module will install the module as part of the upgrade. Clearing the checkbox next to a module will uninstall the module during the upgrade. Text mode- you will be presented with a list of all the modules, one at a time. Type "y" to install or upgrade the module, and type "n" to uninstall the module. When you have made your selections, continue on to the next step.



Ready to Install- graphical mode

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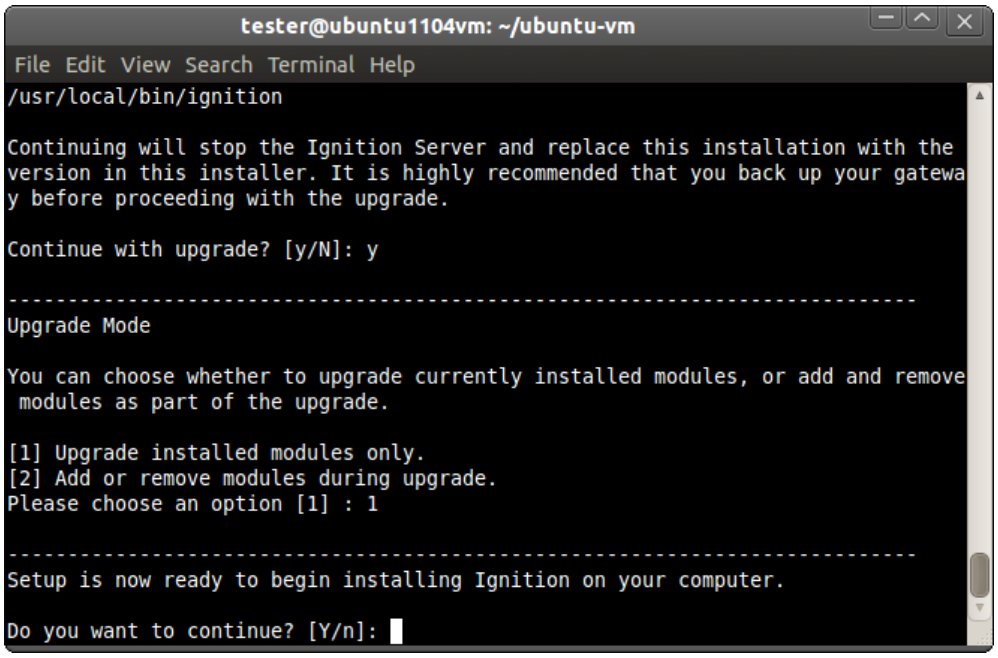
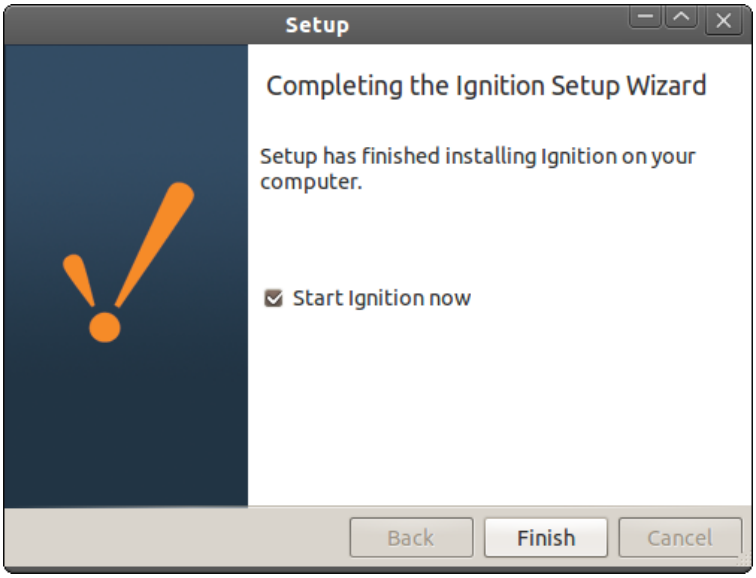

tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
/usr/local/bin/ignition
Continuing will stop the Ignition Server and replace this installation with the version in this installer. It is highly recommended that you back up your gateway before proceeding with the upgrade.
Continue with upgrade? [y/N]: y
Upgrade Mode
You can choose whether to upgrade currently installed modules, or add and remove modules as part of the upgrade.
[1] Upgrade installed modules only.
[2] Add or remove modules during upgrade.
Please choose an option [1] : 1
Setup is now ready to begin installing Ignition on your computer.
Do you want to continue? [Y/n]:

Ready to Install- text mode

Ignition is ready to be upgraded. At this point, you may click the Back button (graphical mode) to change your selections. For the text mode, you can only abort the upgrade at this point by typing "n". Click the Next button (graphical mode) or type "y" (text mode) to finish the upgrade.



Installation complete- graphical mode

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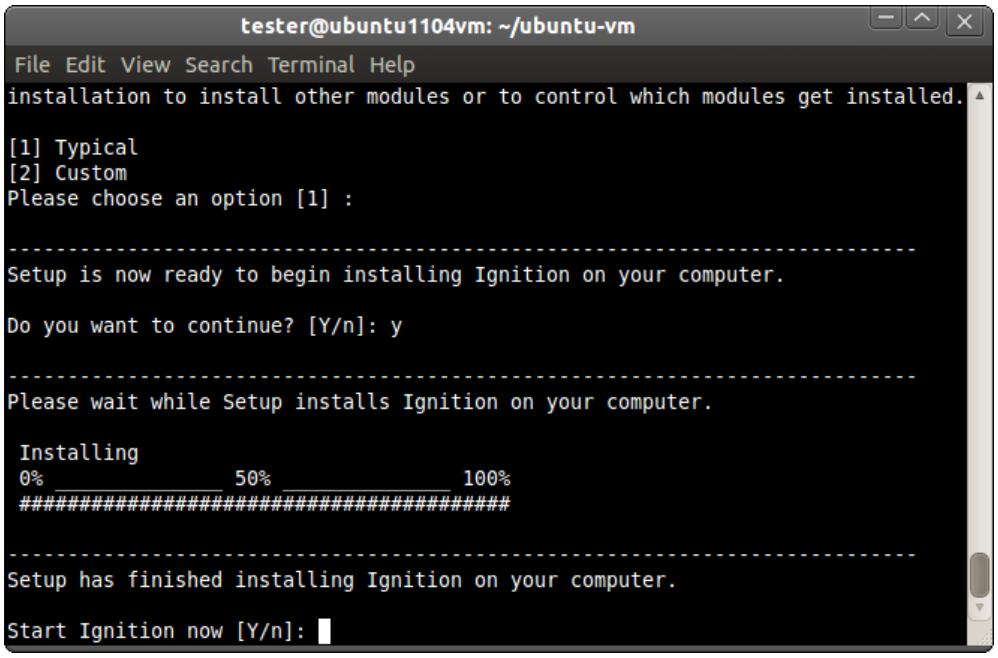
tester@ubuntu1104vm: ~/ubuntu-vm
File Edit View Search Terminal Help
installation to install other modules or to control which modules get installed.
[1] Typical
[2] Custom
Please choose an option [1] :
Setup is now ready to begin installing Ignition on your computer.
Do you want to continue? [Y/n]: y
Please wait while Setup installs Ignition on your computer.
Installing
0% 50% 100%
Setup has finished installing Ignition on your computer.
Start Ignition now [Y/n]:

Installation complete- text mode

When the upgrade is complete, press the "Finish" button (graphical mode) or type "y" to start Ignition or "n" to simply exit (text mode). If you have chosen to start Ignition now, then Ignition will be started as a background process. Use a web browser to navigate to `http://localhost:8088` to confirm that your Gateway is running. For instructions on how to stop or start Ignition, see the Installation (Linux) section.

Automated upgrade

Ignition can be silently upgraded from a command shell without showing any user prompts. Keep in mind that you should make a Gateway backup before performing any type of upgrade. Also, the installer cannot automatically start the Gateway after a silent upgrade. Use the `/etc/init.d/ignition start` command as shown below.

Command line example:

```
gwcmd -b /var/backups/mybackup.gwbk

sudo ./ignition-7.x.x-linux-x64-installer.run --mode unattended --unattendedmodeui
none --autoupgrade true

/etc/init.d/ignition start
```

Flags:

`-- mode unattended` (ensures that no prompts appear during installation)

`-- unattendedmodeui none | minimal` (the 'none' flag will not display any sort of graphic during installation; the 'minimal' flag will display a small progress bar and nothing else, but only if you are working in a graphical system)

`-- autoupgrade true` (runs the installer in upgrade mode)

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8.6 Uninstallation

Uninstallation

Ignition installations contain an uninstaller executable that is created during a new installation. When Ignition is uninstalled, the settings database and folder (contained in the /data) folder is backed up to /data_<current date>. Similarly, modules and user-supplied JDBC jars (contained in the /user-lib folder), are backed up to /user-lib_<current date>. The Ignition service is also removed from Windows and Ubuntu Linux installations automatically. Be sure to back up your gateway and unactivate your gateway license before uninstalling!

Windows:
To run the uninstaller, open the start menu and navigate to `Programs > Inductive Automation > Ignition` and select `Uninstall Ignition.` The uninstaller wizard will guide you through the uninstallation process. You can also uninstall `Ignition` from the Add/Remove Programs section of the Windows Control Panel.

Linux (using downloaded installer):
Linux installations contain an uninstaller executable as long as the original installation was Ignition 7.3 or later. To run the uninstaller, open a command shell and navigate to `/user/local/bin/ignition` (or your installation folder) and run **`./uninstall`** as `root` or `sudo`.

Linux Ignition installations before 7.3 utilized a zip file that was exploded in place to form an installation. Since these installations were never created with an installer executable, no uninstaller executable was ever generated. This is true even if using a 7.3 or later installer executable to upgrade an installation from before 7.3. For these installations, you must manually remove the Ignition folders using the commands below.

`/etc/init.d/`ignition `stop`
Ubuntu only `update-rc.d -f` ignition `remove`
`rm /etc/init.d/`ignition
`rm -rf /usr/local/bin/`ignition
Recommended `mv /var/lib/`ignition`/data /var/lib/`ignition`/data_<current date>`
Recommended `mv /var/lib/`ignition`/user-lib /var/lib/`ignition`/user_lib_<current date>`
Recommended `mv /etc/`ignition `/etc/`ignition`_<current date>`
`rm -rf /var/log/`ignition

Ubuntu Package Management Uninstallation:
Installations using the Ubuntu Package Manager offer the choice to remove the installation while retaining the configuration files in /etc, or to completely purge the installation from the system. If you choose to purge the installation, Ubuntu will need to download Ignition again if you would like to reinstall Ignition.

Simple removal: open a command shell and run **`sudo apt-get remove ignition`** (for stable installations) or **`sudo apt-get remove ignition-beta`** (for beta installations).

Full removal and purge: open a command shell and run **`sudo apt-get purge ignition`** (for stable installations) or **`sudo apt-get purge ignition-beta`** (for beta installations).

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8.7 Licensing and Activation

One thing to consider when deploying an Ignition installation to production use is the manner in which it will be licensed.

If you anticipate that the installation might move from server to server frequently you may want to consider purchasing a USB license key to ease transition to new servers. This also makes things more convenient when the server is being deployed in an area without an active internet connection.

Otherwise a file-based licensing scheme can be used. If you have an internet connection you can activate the installation online. Otherwise you can download an activation request file and put it on a portable memory device and take it to a workstation with an active internet connection. From there you can upload the file to the Inductive Automation website and you will receive a license file, called `license.ipl`, in return. Take this file back to the gateway you are trying to activate and under `System > Licensing` you can upload and activate the license.

Information Collected at Activation

When activating an Ignition installation there are several pieces of information that are communicated to the activation servers and then stored internally at Inductive Automation. Some of this information is used to generate a unique license for the server on which Ignition is being installed. The following information is collect at the time of activation:

CD Key
System ID - a hash representing the hard drive serial number (windows) or inode number of the /bin folder (linux)
Java Runtime Version
Java Vendor
Java Version
Java Virtual Machine Name
Java Virtual Machine Vendor
OS Architecture
OS Name
OS Version
Processor Count
Total Physical Memory

8.8 Making Backups

Backups can be made by going to `System > Backup/Restore` on the Ignition Gateway. Click the "Download Backup" button and save the file somewhere safe -- ideally somewhere that *DOES NOT* reside on the same machine running the gateway.

Backups save the user data inside the Ignition Gateway server. This includes all projects, drivers, images, and configuration, but not the modules.

8.9 Restoring from a Backup

Restoring from a backup is done under the `System > Backup/Restore` section on the Ignition Gateway. Click "Choose File", navigate to your backup file, and then click "Restore". The Gateway will need to restart itself to apply the restored settings.

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See also:
Making Backups

8.10 Transferring Servers

There are only two things to consider when transferring your installation to a new server.

On The Old Server

1. Unactivate

If you are using a USB licensing key then this step is simple. Remove the USB key from this machine and transfer it to the other machine.

If not, you need to first visit the System > Licensing section of the Ignition Gateway and follow the link to unactivate. **This step is important.** If you do not unactive first you will either use up available activations, if your account has them, or need to contact support and get your installation unactivated manually over the phone.

2. Backup

You need either a copy of the *most recent* backup (You are making backups, right? See the Making Backups section for more information) or to go ahead and make a backup at this point in time. This backup file is how you will transfer your existing settings to the new server.

On The New Server

1. Restore

Restore your settings using the backup file from the old server. Restoring from a backup is done under the `System > Backup/Restore` section on the Ignition Gateway. Click "Choose File", navigate to your backup file, and then click "Restore".

2. Activate

Activate your new installation of Ignition.

8.11 Gateway Homepage Customization

The Ignition Gateway home page can be customized to display only the information you want. On a new installation there are a number of panels that are helpful when beginning a project but when it comes time to deploy to production may no longer be necessary.

You can find these options on the "Homepage Config" tab in the `Configuration > Gateway Settings` section of the Ignition Gateway.

The following panels can be expanded/shrank or enabled/disabled:

Welcome to the Ignition Gateway
Launch Projects
Transaction Groups
Devices
Java Detection

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8.12 Gateway Web Security

The Gateway's web interface can be secured in two ways: password protected sections and encrypted communication.

SSL

You can turn on SSL mode in the Gateway Configuration section under Configuration > Gateway Settings > Use SSL. This will make all communication for Clients, Designers, and web browsers using the web interface use encrypted SSL connections.

Password Protection

By default, the Configuration section is password protected, and this cannot be removed. You can also optionally protect the Status and the Home sections of the Gateway. You can also alter the *roles* that are required to access any of these sections. These settings are altered under Configuration > Gateway Settings.

8.13 Gateway Monitoring

The Ignition Gateway can be monitored in detail under the **Status section** or from the **Gateway Control Utility**.

The Status section is broken down into the following parts.

Overview

The overview provides a top-down view of many of the components of your Gateway. This view is also useful for determining what step might be next when setting up your Ignition Gateway for the first time. You can view the status of your database connections, device connections, OPC connections, the number of open clients and the number of open designers.

Modules

A list of installed modules, their status, as well information about their version and current license state.

SQLTags

The SQLTags section lists information and statistics about all configured SQLTags Providers as well as a view into the SQLTags subscription model, scan classes, and what tags it is currently subscribed to.

Database Connections

This important section shows your database connections, their status, and their current load. Each status panel has information about the connection such as queries/second, total queries, and the average query duration.

Store & Forward

The Store & Forward section shows you what each of your S&F engines are doing. They show the number of pending and quarantined records that exist in the various stages of the S&F engines, as well as the throughput of records going through each stage. Note that if the final sink (the Database Storage) is available, data will jump directly from the memory buffer to the database storage, skipping the local cache.
See also: Data Quarantining.

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OPC Connections

All of your OPC connections and any subscriptions you have made through these connections will be shown in this section. You can view the status of any connection as well as find details for trouble shooting when the status is bad. Statistics on the number of reads, writes, and updates are also kept.

Sessions

This section shows details about all of the Designer and Client sessions that are communicating with this Gateway. You can see detail about their subscriptions, user credentials, etc.

Ignition OPC-UA Server (Requires OPC-UA Module)

This section has two tabs of information.

The first tab is the Devices tab. Here you will find a list of all configured devices, the status for each device, as well as details about the driver that device is using.

The second tab is the Server Statistics tab. This is a set of basic performance statistics accumulated for the duration the server has been running as well as a list of subscriptions and their corresponding subscribed nodes that the server currently knows about.

8.14 Installing a Genuine SSL Certificate

When you turn on SSL in Ignition, the web browser uses what is called a "self-signed" certificate. This gives you the *encryption* benefits of SSL, but not the identity validation, and it isn't a 'real' certificate. This is why a web browser will display nasty warnings to users that they shouldn't trust the website.

We are not able to ship a real certificate with Ignition because SSL certificates have to be purchased individually from a **certificate authority**, such as Verisign, GoDaddy, or Comodo.

This guide will show you how to purchase and install a real SSL certificate from a certificate authority and install it in Ignition. You'll need to be comfortable executing command-line programs in order to complete this guide. The examples in this guide assume a Windows environment, but the general procedure would be identical in Linux.

1. Install the JDK

There are some command-line tools you'll need to use to create a certificate request and to install your certificate. These tools come with the Java Development Kit (JDK). It is likely that you only have the Java Runtime Environment (JRE) installed. Go to http://java.oracle.com and click on *Java SE*. Download the Java SE 6 JDK and install it.

2. Open a command prompt

Open a command prompt *(Start > Run > cmd)* and change directory into your JDK tools directory.

```
cd C:\Program Files\Java\jdk1.6.0_24\bin
```

3. Create your keystore

SSL certificates for Ignition are stored in a file called a *keystore*. You'll need to create your own keystore file with a certificate in it before you can purchase the SSL certificate.

a. Enter the following command:

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```
keytool -genkey -alias tomcat -keyalg RSA -keysize 2048 -keystore C:
\ssl.key
```
(you can put the file wherever you want for now but it should be called "ssl.key")

b. It will prompt you to enter a password. Use the password: `ignition`

c. You will then be prompted for your "first and last name". *Do not* actually use your first and last name. This value *must* be *one* of these for your Ignition Gateway:
   1. Fully Qualified Domain Name (e.g. "secure.yourdomain.com")
   2. Public IP address (e.g. "202.144.8.10")
   3. Full Server Name of your internal server (e.g. "scadaserver")
   4. Private IP address (e.g. "192.168.0.1")

d. It will then prompt you for information about your company. Input all data accurately, as the certificate authority will need to verify this information.

e. Lastly, it will ask you for the password for alias `<tomcat>`. Press `RETURN` to use the same password as the keystore file

4. Generate a Certificate Signing Request

At this point, you have a keystore file named "ssl.key" at the root of your C:\ drive (or wherever you specified it to be in step 3a)

In your command prompt window, enter this command:

```
keytool -certreq -alias tomcat -file C:\csr.txt -keystore C:\ssl.key
```

It will prompt you for the keystore password (`ignition`). You now have a certificate request file at `C:\csr.txt`

5. Buy the SSL certificate

Now you need to get your SSL certificate signed by a certificate authority. When you go to a certificate authority (Verisign, GoDaddy, Comodo, etc), they'll ask for your CSR, which is the `csr.txt` file that you created in step 4. Typically they'll ask you to paste your CSR into their web form. Open csr.txt in notepad, and copy-and-paste it into the certificate authority's form.

If prompted what software generated the CSR, choose Tomcat or Java

After the certificate authority has processed your payment and reviewed your CSR, they will send you your certificate via email.

6. Install the SSL certificate

After your SSL certificate has been emailed to you, you will want to follow the instructions provided for installing the certificate into a Java keystore. Your certificate authority will provide these instructions. The following is the procedure for installing a Comodo SSL certificate, provided as an example:

a. Extract the certificate files that were emailed to you, in this example they were extracted to C:\cert

b. Install the root certificate with the following command:
```
keytool -import -trustcacerts -alias root -file C:
\cert\AddTrustExternalCARoot.crt -keystore C:\ssl.key
```

c. Install the COMODO intermediate certificate:
```
keytool -import -trustcacerts -alias INTER -file C:\cert\COMODOHigh-
AssuranceSecureServerCA.crt -keystore C:\ssl.key
```

d. Install your server's certificate:
```
keytool -import -trustcacerts -alias tomcat -file C:\cert\192_168_1_7.
```

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```
crt -keystore C:\ssl.key
```

7. Replace Ignition's default keystore

You now have a keystore file at `C:\ssl.key` that holds your SSL certificate. The certificate alias is "`tomcat`" and the password is "`ignition`". You can now replace the keystore file that ships with Ignition with your file. Make a backup of the file at `C:\Program Files\Inductive Automation\Ignition\tomcat\ssl.key` and replace it with your keystore file. You will need to restart the Ignition service after replacing this file.

Make sure your SSL port is allowed through your server's firewall. The default SSL port is 8043, and can be changed to the standard SSL port (443) through the Gateway Control Utilitiy (GCU).

If you have a redundant installation, you'll need to repeat this procedure on your backup server and buy a second certificate for it.

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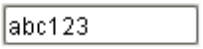
Appendix A. Components

Part IX

9 Appendix A. Components

9.1 Input

9.1.1 Text Field



A basic Text Field component

Description

The Text Field component is used for input of any single-line text. This component will accept any alpha-numeric input. If you're looking for a numeric field, see the Numeric Text Field.

This field features a *protected mode*. When you enable the `protectedMode` property, the field is not editable even when it recieves input focus. The user must *double click* on the field or *press enter* in order to edit the field. When they are done (press enter again or leave the field), the field becomes non-editable again.

The Text Field also supports the *reject updates during edit* feature. This feature ignores updates coming from property bindings while the component is being edited by a user.

Properties

Appearance

Font	Font of text of this component	
	Scripting name	`font`
	Data type	Font
Foreground Color	The foreground color of the component.	
	Scripting name	`foreground`
	Data type	Color
Background	The background color of the text box (when editable)	
	Scripting name	`editableBackground`
	Data type	Color
Non-Editable Background	The background color to use when this text box is non-editable	
	Scripting name	`nonEditableBackground`
	Data type	Color
	Flags	expert
Styles	Contains the component's styles	
	Scripting name	`styles`
	Data type	Dataset
	Flags	bindable | expert

Behavior

Editable?	If true, this is an input box, if false, this is display-only.	
	Scripting name	`editable`

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Data type boolean

Defer Updates
When true, the 'text' property will not fire updates while typing, it will wait for Enter to be pressed.
Scripting name `deferUpdates`
Data type boolean

Protected Mode?
If true, users will need to double-click in the field in order to edit the text.
Scripting name `protectedMode`
Data type boolean

Commit On Focus Loss
If true, any pending edit will take effect when focus is lost. If false, the user must press ENTER for an edit to take effect.
Scripting name `commitOnFocusLost`
Data type boolean

Reject Updates During Edit
If true, this field will not accept updates from external sources (like DB bindings)
while the user is editing the field.
Scripting name `rejectUpdatesDuringEdit`
Data type boolean
Flags expert

Maximum Characters
The text box will be limited to this number of characters. Use -1 for unlimited.
Scripting name `maxChars`
Data type int

Touchscreen Mode
Controls when this input component responds if touchscreen mode is enabled.
Scripting name `touchscreenMode`
Data type int
Flags expert
Values
0 None
1 Single-Click
2 Double-Click

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name `componentEnabled`
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of

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this component.

Scripting name	`toolTipText`
Data type	String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Text — Text of this component

Scripting name	`text`
Data type	String
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

Horizontal Alignment — Determines the alignment of the label's contents along the X axis

Scripting name	`horizontalAlignment`
Data type	int
Flags	expert
Values	**2** Left **0** Center **4** Right **10** Leading **11** Trailing

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- focus
- propertyChange
- key

Scripting Functions

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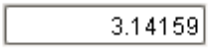
`getSelectedText()` Returns the currently selected or highlighted text in the text field.

Parameters	none
Returns	String

9.1.2 Numeric Text Field

A basic Numeric Text Field



Numeric Text Field editing a floating-point value

Description

The Numeric Text Field is similar to the standard Text Field, except that it is specialized for use with numbers. Instead of a "text" property, it has four numeric "value" properties. Which one you use depends on the *mode* of the text box.

Like the standard Text Field, this text field can operate in *protected mode*. When you enable the protected property, the field is not editable even when it recieves input focus. The user must double click on the field or press enter in order to edit the field. When they are done (press enter again or leave the field), the field becomes non-editable again.

The Numeric Text Field also supports the *reject updates during edit* feature. This feature ignores updates coming from property bindings while the component is being edited by a user.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color

Background — The background color of the text box (when editable)

Scripting name	`editableBackground`
Data type	Color

Non-Editable Background — The background color to use when this text box is non-editable

Scripting name	`nonEditableBackground`
Data type	Color
Flags	expert

Decimal Format — The formatting string used for displaying numbers.

Scripting name	`decimalFormat`
Data type	String

Suffix — A string to display after the value.

Scripting name	`suffix`
Data type	String

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Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Use Bounds? — Only allows user-entered values between a minimum and maximum. Unless you turn on "Error on out-of-bounds", user-entered values will be silently modified to be in-bounds.

Scripting name	`useBounds`
Data type	boolean

Error on Out-of-Bounds — Show an error message if the user input is out-of-bounds?

Scripting name	`errorOnOutOfBounds`
Data type	boolean

Out Of Bounds Message — The error message to display if input is out of bounds

Scripting name	`outOfBoundsMessage`
Data type	String
Flags	expert

Editable? — If true, this is an input box, if false, this is display-only.

Scripting name	`editable`
Data type	boolean

Defer Updates — When true, the value properties will not fire updates while typing, it will wait for Enter to be pressed.

Scripting name	`deferUpdates`
Data type	boolean

Protected Mode? — If true, users will need to double-click in the field in order to edit the value.

Scripting name	`protectedMode`
Data type	boolean

Commit On Focus Loss — If true, any pending edit will take effect when focus is lost. If false, the user must press ENTER for an edit to take effect.

Scripting name	`commitOnFocusLost`
Data type	boolean

Reject Updates During Edit — If true, this field will not accept updates from external sources (like DB bindings)
while the user is editing the field.

Scripting name	`rejectUpdatesDuringEdit`
Data type	boolean
Flags	expert

Touchscreen Mode — Controls when this input component responds if touchscreen mode is enabled.

Scripting name	`touchscreenMode`
Data type	int
Flags	expert
Values	0 None 1 Single-Click 2 Double-Click

Common

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Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name `componentEnabled`
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name `cursorCode`
Data type int
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize
`8` N Resize
`9` S Resize
`10` W Resize
`11` E Resize

Data

Number Type
What type of numbers should this field accept?
Scripting name `mode`
Data type int
Values
`0` Integer
`3` Double
`1` Long
`2` Float

Maximum
The maximum value (inclusive), if useBounds is true.
Scripting name `maximum`
Data type double
Flags bindable

Minimum
The minimum value (inclusive), if useBounds is true.
Scripting name `minimum`

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Data type double
Flags bindable

Value (Integer) — The value as an integer. Make sure you use the value property that corresponds to your Number Type setting.

Scripting name `intValue`
Data type int
Flags bindable

Value (Double) — The value as a double. Make sure you use the value property that corresponds to your Number Type setting.

Scripting name `doubleValue`
Data type double
Flags bindable

Value (Long) — The value as a long. Make sure you use the value property that corresponds to your Number Type setting.

Scripting name `longValue`
Data type long
Flags bindable

Value (Float) — The value as a float. Make sure you use the value property that corresponds to your Number Type setting.

Scripting name `floatValue`
Data type float
Flags bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Layout

Horizontal Alignment — Determines the alignment of the label's contents along the X axis

Scripting name `horizontalAlignment`
Data type int
Flags expert
Values
- **2** Left
- **0** Center
- **4** Right
- **10** Leading
- **11** Trailing

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- focus
- propertyChange
- key

Scripting Functions

`getSelectedText()` Returns the currently selected or highlighted text in the text field.

Parameters none

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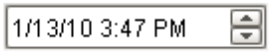
Returns String

9.1.3 Spinner

A Spinner in Integer mode



A Spinner in Date mode

Description

The spinner component represents a value that is part of a series of values, such as numbers and dates. It allows you to not only edit the value directly, but to 'spin' the value up or down, using the up and down buttons that are part of the component. When setting up property bindings, make sure you use the value property that corresponds to the spinner mode. For example, if you chose the *Double* spinner mode, you should bind the `doubleValue` property.

Properties

Appearance

Font — Font of text of this component

Scripting name `font`
Data type Font

Foreground Color — The foreground color of the component.

Scripting name `foreground`
Data type Color

Background Color — The background color of the component.

Scripting name `background`
Data type Color

Number Format — A number format pattern to use when the spinner is in numeric mode.

Scripting name `numberFormat`
Data type String

Date Format — A date format pattern to use when the spinner is in date mode.

Scripting name `dateFormat`
Data type String

Styles — Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Behavior

Spinner Mode — The mode controls which data type this spinner accepts

Scripting name `spinnerMode`
Data type int
Values
0 Integer
1 Double
2 Date

Date Step Size — The amount to step up or down when in 'Date' mode.

Scripting name `dateStepSize`

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Data type int
Values
1 Year
2 Month
3 Week
5 Day
10 Hour
12 Minute
13 Second
14 Millisecond

Numeric Step Size
The size to step up or down when in 'Integer' or 'Double' mode.
Scripting name stepSize
Data type double

Touchscreen Mode
Controls when this input component responds if touchscreen mode is enabled.
Scripting name touchscreenMode
Data type int
Flags expert
Values
0 None
1 Single-Click
2 Double-Click

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name componentEnabled
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name border
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name toolTipText
Data type String

Opaque
If false, backgrounds are not drawn. If true, backgrounds are drawn.
Scripting name opaque
Data type boolean

Data

Numeric Minimum
The minimum value this spinner will accept when in 'Integer' or 'Double' mode.
Scripting name minValue
Data type double

Numeric Maximum
The maximum value this spinner will accept when in 'Integer' or 'Double'

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mode.

Scripting name `maxValue`
Data type double

Value (Integer) — The current value if mode is 'Integer'

Scripting name `intValue`
Data type int
Flags bindable

Value (Double) — The current value if mode is 'Double'

Scripting name `doubleValue`
Data type double
Flags bindable

Value (Date) — The current value if mode is 'Date'

Scripting name `dateValue`
Data type Date
Flags bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Uncategorized

Date in Milliseconds

Scripting name `dateInMillis`
Data type long
Flags bindable | read-only

Scripting

Events

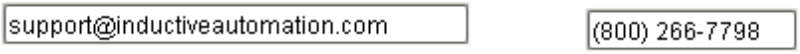
The following event sets are fired by this component. See Component Event Handlers to learn more.

propertyChange

Scripting Functions

This component has no special scripting functions.

9.1.4 Formatted Text Field



With an email-address regular expression filter

With a US phone-number mask formatter

Description

This specialized text field is used for alphanumeric text input that must match some specific pattern or needs to be formatted in a specific way. It operates in two modes:

Formatted Mask

In this mode, input is automatically formatted and restricted based on a *format mask*. For example, a format mask like: `(###) ###-####` will allow the entry of a 10-digit US phone number. The formatting characters are automatically inserted if the user does not type them in. Any other

characters are restricted. The following characters may be used in a formatted mask pattern:

#	Any valid number, Such as 0-9.
'	Escape character, used to escape any of the special formatting characters.
U	Any letter. All lowercase letters will be mapped to upper case automatically.
L	Any letter. All upper case letters will be mapped to lower case automatically.
A	Any letter or number.
?	Any letter, case is preserved.
*	Anything.
H	Any hex character (0-9, a-f or A-F).

Examples:

##U-####/UU	A product code with a specifc format, like 28E-8213/AR
0xHHHH	A hex digit, automatically prepends "0x" no the front. e.g. "0x82FF"
#UUU###	A California license plate, eg. 4ABC123

Regular Expression

In this mode, input is validated against a regular expression. A regular expression is a special string that defines a set of allowed strings. See http://en.wikipedia.org/wiki/Regular_expression. Any input that matches the given regular expression is allowed, and input that doesn't match, is restricted. And yes, while powerful, regular expressions are decidedly difficult to decipher.

Examples:

\p{Upper}\p{Lower}*, \p{Upper}\p{Lower}*	A name, formatted such as Smith, John
\d{3}-\d{2}-\d{4}	A US social security number, like 123-45-6789
\d{1,3}\.\d{1,3}\.\d{1,3}\.\d{1,3}	A network IPv4 address, like 67.82.120.116
^[a-f0-9A-F]{6}$	A six-digit hexadecimal number.

Properties

Appearance

Font — Font of text of this component

Scripting name	font
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	foreground
Data type	Color

Background Color — The background color of the component.

Scripting name	background
Data type	Color

Styles — Contains the component's styles

Scripting name	styles
Data type	Dataset
Flags	bindable | expert

Behavior

Validation Mode — Select regular expression or mask-driven field validation

Scripting name	validationMode
Data type	int
Values	1 Regular Expression
	2 Formatted Mask

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Formatted Mask Pattern — Formatted Mask Validation Pattern

Scripting name: `formattedMaskPattern`
Data type: String

Reg Ex Pattern — Regular Expression Validation Pattern

Scripting name: `validationPattern`
Data type: String

Allows Invalid Text — Allows Invalid text to Commit

Scripting name: `allowsInvalid`
Data type: boolean

Overwrites Text — Overwrites text while typing

Scripting name: `overwriteMode`
Data type: boolean

Commit While Typing — Commits valid text while user is typing

Scripting name: `commitsOnValidEdit`
Data type: boolean

Focus Lost Behavior — Controls how a transaction can be committed

Scripting name: `focusLostBehavior`
Data type: int
Values:
- 2 Revert
- 1 Commit or Revert
- 0 Commit
- 3 Persist

Touchscreen Mode — Controls when this input component responds if touchscreen mode is enabled.

Scripting name: `touchscreenMode`
Data type: int
Flags: expert
Values:
- 0 None
- 1 Single-Click
- 2 Double-Click

Common

Name — The name of this component.

Scripting name: `name`
Data type: String
Flags: bindable

Enabled — If disabled, a component cannot be used.

Scripting name: `componentEnabled`
Data type: boolean

Visible — If disabled, the component will be hidden.

Scripting name: `visible`
Data type: boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name: `border`
Data type: Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of

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this component.

Scripting name `toolTipText`
Data type String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name `opaque`
Data type boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Text — Contents of this Text Field

Scripting name `text`
Data type String

Committed Value — Committed Text Value

Scripting name `committedValue`
Data type String
Flags bindable | expert

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Layout

Horizontal Alignment — Determines the alignment of the label's contents along the X axis

Scripting name `horizontalAlignment`
Data type int
Flags expert
Values

2	Left
0	Center
4	Right
10	Leading
11	Trailing

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse

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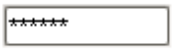
mouseMotion
focus
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.1.5 Password Field



A basic Password component

Description

A password field is like a text field that doesn't display the text that is being edited. You may alter the *echo character* (`*`) if you'd like.

Properties

Appearance

Font	Font of text of this component	
	Scripting name	`font`
	Data type	Font
Foreground Color	The foreground color of the component.	
	Scripting name	`foreground`
	Data type	Color
Background Color	The background color of the component.	
	Scripting name	`background`
	Data type	Color
Echo Character	The character that is displayed instead of the real ones.	
	Scripting name	`echoCharacter`
	Data type	String
Styles	Contains the component's styles	
	Scripting name	`styles`
	Data type	Dataset
	Flags	bindable | expert

Behavior

Touchscreen Mode	Controls when this input component responds if touchscreen mode is enabled.	
	Scripting name	`touchscreenMode`
	Data type	int
	Flags	expert
	Values	**0** None **1** Single-Click **2** Double-Click

Common

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Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled — If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	`opaque`
Data type	boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Text — Text of this component

Scripting name	`text`
Data type	String
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

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Events

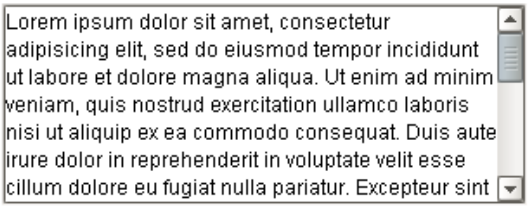
The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- focus
- propertyChange
- key

Scripting Functions

This component has no special scripting functions.

9.1.6 Text Area


Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint

A Text Area with line-wrap turned on

Description

Suitable for multi-line text display and editing. Will scroll vertically on demand. Will scroll horizontally if l*ine wrap* is off. Only supports plain-text, no HTML formatting or styled text.

Properties

Appearance

Font	Font of text of this component	
	Scripting name	`font`
	Data type	Font
Foreground Color	The foreground color of the component.	
	Scripting name	`foreground`
	Data type	Color
Background Color	The background color of the component.	
	Scripting name	`background`
	Data type	Color
Rows	The number of rows you expect to display (used as a hint for scrollbars).	
	Scripting name	`rows`
	Data type	int
Columns	The number of columns you expect to display (used as a hint for scrollbars).	
	Scripting name	`columns`
	Data type	int
Styles	Contains the component's styles	
	Scripting name	`styles`

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Data type Dataset
Flags bindable | expert

Behavior

Editable — Controls whether or not the user can edit the text within this text area.

Scripting name `editable`
Data type boolean

Defer Updates — If true, bindings will not affect the component's text while a user is editing the text.

Scripting name `deferUpdates`
Data type boolean

Line Wrap — Should this area wrap lines?

Scripting name `lineWrap`
Data type boolean

Touchscreen Mode — Controls when this input component responds if touchscreen mode is enabled.

Scripting name `touchscreenMode`
Data type int
Flags expert
Values
0 None
1 Single-Click
2 Double-Click

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Enabled — If disabled, a component cannot be used.

Scripting name `componentEnabled`
Data type boolean

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name `opaque`
Data type boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
0 Default

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1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Text — Text of this component

Scripting name	`text`
Data type	String
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

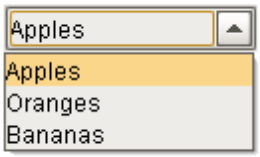
- mouse
- mouseMotion
- focus
- propertyChange
- key

Scripting Functions

This component has no special scripting functions.

9.1.7 Dropdown List

A Dropdown showing a selected value



A Dropdown showing its options

Description

The dropdown component is a great way to display a list of choices in a limited amount of space. The current selection is shown, and the choices are only presented when the user clicks on the dropdown button. The choices that are shown depend on the `data` property. This is a *dataset*, which can be typed in manually in the Designer, or (more commonly) it can be populated dynamically from a property binding, often a SQL Query binding.

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It is often the case that you want to display choices to the user that are 'dressed up' versions of the actual choices. For instance, suppose that you are selecting choices for a downtime tracking entry. The choices might be: "Operator Error", "Machine Malfunction", and "Other". But, you really want to map these choices to some numeric code which is how the choice is stored. So, for instance, when the user chooses "Other" you really want to get the number 3. The dropdown component is perfect for such a use. The `data` property can be set up in one of three fashions, which control how the "selected values" properties change.

The 3 ways to set up the `data` dataset and the corresponding behavior is as follows:

One Column
[String]

Apples
Oranges
Bananas

Dropdown displays values from the first column
Selected Value is undefined
Selected String Value represents value from first column
Selected Label represents value from first column

Two Columns
[Integer, String]

201	Apples
202	Oranges
203	Bananas

Dropdown displays values from second column
Selected Value represents value from first column
Selected String Value is undefined
Selected Label represents value from second column

Two Columns
[String, String]

APL	Apples
ORN	Oranges
BAN	Bananas

Dropdown displays values from second column
Selected Value is undefined
Selected String Value represents value from first column
Selected Label represents value from second column

The dropdown component can operate in one of three *Selection Modes*. These modes affect how the dropdown's current selection (defined by the values of its Selected Value, Selected String Value, and Selected Label properties) behave when the selection properties are set to values not present in the choice list, or conversely, when the choice list is set to a new dataset that doesn't contain the current selection:

Strict. Selected values must always correlate to an option in the list defined by the Data property. If an invalid selection is set (via a binding or a script), the selection will be set to the values defined by the No Selection properties. If the Data property is set to a list that does not contain the current selection, the current selection will be reset to the No Selection values.

Lenient. *(default)* Selected values are independent of the list defined by the Data property. This mode is useful to avoid race conditions that can cause problems in Strict mode when both the Data and the Selected Value properties are bound. If the current selection is not present in the Data list, the read-only property Selected Index will be -1.

Editable. The same selection rules as defined by Lenient mode, except that the dropdown itself becomes editable, allowing a user to type in their own arbitrary value. This value will be set as the dropdown's Selected Label.

Properties

Appearance

Font	Font of text of this component

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Scripting name `font`
Data type Font

Foreground Color — The foreground color of the component.

Scripting name `foreground`
Data type Color

Background Color — The background color of the component.

Scripting name `background`
Data type Color

Selection Background — The background color of a selected cell in the dropdown list.

Scripting name `selectionBackground`
Data type Color
Flags expert

Dropdown Display Mode — Changes the dropdown's display

Scripting name `mode`
Data type int
Values
`0` List
`1` Table

Max Row Count — The number of rows to display in the dropdown list before displaying a scrollbar.

Scripting name `maximumRowCount`
Data type int
Flags expert

Hide Table Columns? — A comma separated list of columns to hide from the dropdown table, eg. 0,2 (only used in table mode)

Scripting name `hideTableColumns`
Data type String
Flags expert

Show Table Header? — Selects whether or not the dropdown table header is displayed. (only used in table mode)

Scripting name `showTableHeader`
Data type boolean
Flags expert

Max Table Width — The maximum width allowed for the dropdown table. (only used in table mode)

Scripting name `maxTableWidth`
Data type int
Flags expert

Max Table Height — The maximum height allowed for the dropdown table. (only used in table mode)

Scripting name `maxTableHeight`
Data type int
Flags expert

Styles — Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Behavior

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Selection Mode

The selection mode determines the behavior of the dropdown: whether its selected value must strictly be in the underlying set of choices, whether it is flexible, or even user-editable.

Scripting name	`selectionMode`
Data type	int
Values	**0** Strict **1** Lenient **2** Editable

No Selection Value

The value when nothing is selected.

Scripting name	`noSelectionValue`
Data type	int
Flags	expert

No Selection String

The string value when nothing is selected.

Scripting name	`noSelectionString`
Data type	String
Flags	expert

No Selection Label

The label to display when nothing is selected.

Scripting name	`noSelectionLabel`
Data type	String
Flags	expert

Common

Name

The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled

If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible

If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize

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5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Data

The data which fills up the combo box. Either a 1 or 2 column DataSet, with the first column being the value, and the second being the display

Scripting name	`data`
Data type	Dataset
Flags	bindable

Selected Value

The currently selected value

Scripting name	`selectedValue`
Data type	Integer
Flags	bindable

Selected String Value

The currently selected value, if the value column is a string

Scripting name	`selectedStringValue`
Data type	String
Flags	bindable

Selected Label

The currently selected label

Scripting name	`selectedLabel`
Data type	String
Flags	bindable

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

Horizontal Alignment

Determines the alignment of the contents along the X axis

Scripting name	`horizontalAlignment`
Data type	int
Flags	expert
Values	2 Left
	0 Center
	4 Right
	10 Leading
	11 Trailing

Vertical Alignment

Determines the alignment of the contents along the Y axis

Scripting name	`verticalAlignment`
Data type	int
Flags	expert
Values	1 Top
	0 Center
	3 Bottom

Uncategorized

Selected Index

The index of the selected item.

Scripting name	`selectedIndex`
Data type	int
Flags	bindable | read-only

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Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

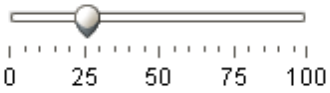
mouse
mouseMotion
focus
propertyChange
key

Scripting Functions

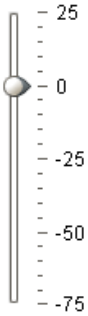
This component has no special scripting functions.

9.1.8 Slider

A basic Slider



A Slider with tickmarks and labels, 0-100



A vertical Slider with a custom range

Description

The slider component lets the user drag an indicator along a scale to choose a value in a range. The **Defer Updates** property determines whether or not the slider's **Value** changes as the user drags the mouse, or whether it waits until the user drops the slider handle.

Properties

Appearance

Font	Font of text of this component
	Scripting name `font`
	Data type Font
Foreground Color	The foreground color of the component.
	Scripting name `foreground`
	Data type Color
Background Color	The background color of the component.
	Scripting name `background`
	Data type Color
	Flags expert
Horizontal Slider	If true, slider is horizontal. Otherwise, it's vertical

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Scripting name horizontal
Data type boolean

Major Tick Spacing — The distance, measured in values, between each major tick mark

Scripting name majorTickSpacing
Data type int

Minor Tick Spacing — The distance, measured in values, between each minor tick mark

Scripting name minorTickSpacing
Data type int

Paint Track? — If true, the trac of the slider will be shown.

Scripting name paintTrack
Data type boolean

Paint Labels? — If true, value labels will be shown.

Scripting name paintLabels
Data type boolean

Paint Ticks? — If true, value tick marks will be shown.

Scripting name paintTicks
Data type boolean

Styles — Contains the component's styles

Scripting name styles
Data type Dataset
Flags bindable | expert

Behavior

Defer Updates — Only publish updates to value when not actively being changed.

Scripting name deferred
Data type boolean

Snap To Ticks?

Scripting name snapToTicks
Data type boolean

Inverted? — Specify true to reverse the value range shown for the slider and false to put the value range in the normal order.

Scripting name inverted
Data type boolean

Common

Name — The name of this component.

Scripting name name
Data type String
Flags bindable

Enabled — If disabled, a component cannot be used.

Scripting name componentEnabled
Data type boolean

Visible — If disabled, the component will be hidden.

Scripting name visible
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

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Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Opaque — If true, the background of the slider is drawn.

Scripting name `opaque`
Data type boolean
Flags expert

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Value — The current value of the slider.

Scripting name `value`
Data type int
Flags bindable

Minimum Value — The value when the slider is all the way left or down

Scripting name `minimum`
Data type int
Flags bindable

Maximum Value — The value when the slider is all the way right or up

Scripting name `maximum`
Data type int
Flags bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion

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focus
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.2 Buttons

9.2.1 Button

A standard push button

Buttons can have images

Buttons can be only images

Buttons can display state

Description

The Button component is a versatile component, often used for things like opening/closing windows, writing to tags, and triggering any sort of scripting logic. It can be used for showing status, as well. For example, if you have three buttons, Hand, Off, and Auto, not only can they set those modes, but their background color can display the current mode, although you'd be better off using the Multi-State Button for this.

To get buttons to do things, you add an event handler to the `actionPerformed` event. Many new users to the 1.0.0 module will configure an event handler for the `mouseClicked` event instead. While this will work, it is better to use the `actionPerformed` event. Why? Buttons can also be activated by tabbing over to them and hitting the space key, or they could be activated by pressing Alt and the button's *mnemonic* character. So, to make sure that your button works in all of these cases, configure your event handler on the `actionPerformed` event, not the `mouseClicked` event.

See also:
Typical Navigation Strategy
Event Types

Properties

Appearance

Font	Font of text of this component	
	Scripting name	`font`
	Data type	Font
Foreground Color	The foreground color of the component.	
	Scripting name	`foreground`
	Data type	Color
Background Color	The background color of the button.	
	Scripting name	`buttonBG`
	Data type	Color
Background 3D?	Should this button have a 3d type background, or a flat color one?	
	Scripting name	`background3D`
	Data type	boolean

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Flags	expert

Fill Area?

Controls whether or not this button's internal area is filled

Scripting name	`contentAreaFilled`
Data type	boolean
Flags	expert

Border Painted?

Should the border of this button be displayed?

Scripting name	`borderPainted`
Data type	boolean
Flags	expert

Text

Text of this component

Scripting name	`text`
Data type	String
Flags	bindable

Image Path

The relative path of the image.

Scripting name	`path`
Data type	String
Flags	bindable

Disabled Image Path

The relative path of the image to be displayed when this component is not enabled.

Scripting name	`disabledPath`
Data type	String
Flags	expert

Icon-Text Spacing

The space (in pixels) between the icon (if any) and the text (if any)

Scripting name	`iconTextGap`
Data type	int

Styles

Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Rollover

If true, the button may indicate that the mouse is hovering over it.

Scripting name	`rolloverEnabled`
Data type	boolean
Flags	expert

Focusable

If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.

Scripting name	`focusable`
Data type	boolean
Flags	expert

Mnemonic

A single letter that will activate the button using 'ALT-mnemonic'.

Scripting name	`mnemonicChar`
Data type	String

Default Button

If true, this button will be activated when the user presses enter on the window.

Scripting name	`defaultBtn`
Data type	boolean
Flags	expert

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Common

Name

The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled

If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible

If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border
Flags	expert

Opaque

Is this button completely opaque? Most aren't, so this should usually be false.

Scripting name	`opaque`
Data type	boolean
Flags	expert

Data

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

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Margin — The space between a button's text and its borders.

Scripting name	`margin`
Data type	Insets
Flags	expert

Horizontal Alignment — The horizontal alignment of the button's contents (text and/or image)

Scripting name	`horizontalAlignment`
Data type	int
Values	**2** Left **0** Center **4** Right **10** Leading **11** Trailing

Horizontal Text Position — The horizontal position of the button's text relative to its image

Scripting name	`horizontalTextPosition`
Data type	int
Flags	expert
Values	**2** Left **0** Center **4** Right **10** Leading **11** Trailing

Vertical Alignment — The vertical alignment of the button's contents (text and/or image)

Scripting name	`verticalAlignment`
Data type	int
Values	**1** Top **0** Center **3** Bottom

Vertical Text Position — The vertical position of the button's text relative to its image

Scripting name	`verticalTextPosition`
Data type	int
Flags	expert
Values	**1** Top **0** Center **3** Bottom

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
action
focus
propertyChange
key

Scripting Functions

`doClick()` — Virtually "clicks" the button, meaning that its actionPerformed event handler will run.

Parameters	none
Returns	nothing

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9.2.2 2 State Toggle

The default "on" style

The default "off" style

Styles are highly customizable

Description

This button is similar to the basic Toggle Button, but more finely tuned to work in realistic controls environments. Use this button any time you want to toggle a value between two states, such as On/Off, Stop/Run, etc. If you have more than two states (for example, Hand/Off/Auto, use the Multi-State Button).

If you have a tag whose value you want to toggle between 2 values (like zero and one), you can simply drag and drop the tag onto the button. This will bind both the *Control Value* and *Indicator Value* properties to that tag. Now set the *State 1 Value* and *State 2 Value* to your two states (they default to zero and one, respectively). Lastly, use the Styles Customizer to define the styles for your two states.

This button has four integer values that you use to set it up: the *Control Value*, the *Indicator Value*, and values that define the 2 different states: *State 1 Value* and *State 2 Value*. Every time you press the button, one of the state values is written to the control value. The Indicator Value is used to determine which state you're in. For example, suppose that State 1 Value was zero and State 2 Value is one. If Indicator Value is zero and you press the button, it'll write a one to the Control Value. The Style of the component is typically driven by the read-only property *Current State*. Current State equals zero when Indicator Value=State 1 Value and one otherwise.

See also:
Bidirectional Bindings
Component Styles

Properties

Appearance

Font	Font of text of this component	
	Scripting name	`font`
	Data type	Font
Foreground Color	The foreground color of the component.	
	Scripting name	`foreground`
	Data type	Color
Background Color	The background color of the button.	
	Scripting name	`buttonBG`
	Data type	Color
Background 3D?	Should this button have a 3d type background, or a flat color one?	
	Scripting name	`background3D`
	Data type	boolean
	Flags	expert
Fill Area?	Controls whether or not this button's internal area is filled	
	Scripting name	`contentAreaFilled`

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Data type	boolean
Flags	expert

Border Painted? — Should the border of this button be displayed?

Scripting name	`borderPainted`
Data type	boolean
Flags	expert

Text — Text of this component

Scripting name	`text`
Data type	String
Flags	bindable

Image Path — The relative path of the image.

Scripting name	`path`
Data type	String
Flags	bindable

Disabled Image Path — The relative path of the image to be displayed when this component is not enabled.

Scripting name	`disabledPath`
Data type	String
Flags	expert

Icon-Text Spacing — The space (in pixels) between the icon (if any) and the text (if any)

Scripting name	`iconTextGap`
Data type	int

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Rollover — If true, the button may indicate that the mouse is hovering over it.

Scripting name	`rolloverEnabled`
Data type	boolean
Flags	expert

Focusable — If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.

Scripting name	`focusable`
Data type	boolean
Flags	expert

Confirm? — If true, a confirmation box will be shown.

Scripting name	`confirm`
Data type	boolean

Confirm Text — The message to ask the user if confirmation is turned on.

Scripting name	`confirmText`
Data type	String

Mnemonic — A single letter that will activate the button using 'ALT-mnemonic'.

Scripting name	`mnemonicChar`
Data type	String
Flags	expert

Common

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Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled
If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor
The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border
Flags	expert

Opaque
Is this button completely opaque? Most aren't, so this should usually be false.

Scripting name	`opaque`
Data type	boolean
Flags	expert

Data

Data Quality
The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Control Value
Bind this to the tag that controls the state. (Typically, this is bound to the same location as Indicator Value)

Scripting name	`controlValue`

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Data type int
Flags bindable

Indicator Value
Bind this to the tag that indicates the current state. (Typically, this is bound to the same location as Control Value)
Scripting name `indicatorValue`
Data type int
Flags bindable

State 1 Value
The value that will be written to controlValue when the button is pushed in state 2.
Scripting name `state1Value`
Data type int
Flags bindable

State 2 Value
The value that will be written to controlValue when the button is pushed in state 1.
Scripting name `state2Value`
Data type int
Flags bindable

Current State
Read-only property that shows what state (0 or 1) this button is currently in.
Scripting name `state`
Data type int
Flags bindable | expert

Layout

Margin
The space between a button's text and its borders.
Scripting name `margin`
Data type Insets
Flags expert

Horizontal Alignment
The horizontal alignment of the button's contents (text and/or image)
Scripting name `horizontalAlignment`
Data type int
Values
`2` Left
`0` Center
`4` Right
`10` Leading
`11` Trailing

Horizontal Text Position
The horizontal position of the button's text relative to its image
Scripting name `horizontalTextPosition`
Data type int
Flags expert
Values
`2` Left
`0` Center
`4` Right
`10` Leading
`11` Trailing

Vertical Alignment
The vertical alignment of the button's contents (text and/or image)
Scripting name `verticalAlignment`
Data type int
Values
`1` Top
`0` Center
`3` Bottom

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Vertical Text Position — The vertical position of the button's text relative to its image

Scripting name	`verticalTextPosition`
Data type	int
Flags	expert
Values	`1` Top `0` Center `3` Bottom

Scripting

Events

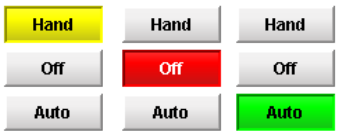
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
action
focus
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.2.3 Multi-State Button



3 Multi-State Buttons showing the default stettings

Many configurations are possible

Description

This button is really a series of two or more buttons, arranged in a column, row, or grid. Each button represents an integer-valued state. Each state defines two styles for a button: the selected style, and the unselected style. Each button is automatically displayed with the correct style based on the current state (the value of Indicator Value). When a button is pressed, it's state's value is written to the Control Value.

To configure a Multi-State Button, simply drag a tag that represents your state onto the Multi-State Button. This will bind both the Control Value and Indicator Value to that tag. Now open up the Multi-State Button customizer, and define your states: their order, values and styles. Lastly choose if you want the buttons to be a column, row, or grid by setting the Display Style property.

See also:
Bidirectional Bindings
Component Customizers

Properties

Appearance

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Font
Font of text of this component
Scripting name font
Data type Font

Display Style
The display style (rows or columns) for this N-state button.
Scripting name displayStyle
Data type int
Values
0 Column
1 Row
2 Grid

Horizontal Gap
The horizontal spacing between buttons
Scripting name hGap
Data type int

Vertical Gap
The vertical spacing between buttons
Scripting name vGap
Data type int

Grid Rows
The number of rows if the Display Style is set to "Grid" mode.
Scripting name gridRows
Data type int

Grid Cols
The number of columns if the Display Style is set to "Grid" mode.
Scripting name gridCols
Data type int

Background 3D?
Controls whether or not the buttons have a gradient-style background color.
Scripting name background3D
Data type boolean
Flags expert

Behavior

Confirm?
If true, a confirmation box will be shown.
Scripting name confirm
Data type boolean

Confirm Text
The message to ask the user if confirmation is turned on.
Scripting name confirmText
Data type String

States
A Dataset that stores the information for the different states.
Scripting name states
Data type Dataset
Flags expert

Rollover
If true, the button may indicate that the mouse is hovering over it.
Scripting name rolloverEnabled
Data type boolean
Flags expert

Focusable
If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.
Scripting name focusableEnabled
Data type boolean
Flags expert

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Common

Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled
If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor
The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Control Value
Bind this to the tag that controls the state. (Typically, this is bound to the same location as Indicator Value)

Scripting name	`controlValue`
Data type	int
Flags	bindable

Indicator Value
Bind this to the tag that indicates the current state. (Typically, this is bound to the same location as Control Value)

Scripting name	`indicatorValue`
Data type	int
Flags	bindable

Data Quality
The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

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The following event sets are fired by this component. See Component Event Handlers to learn more.

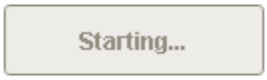
mouse
mouseMotion
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.2.4 One-Shot Button

A One-Shot button, waiting to be pressed



A One-Shot button, waiting for a PLC reset

Description

The latched button is great for telling a PLC to do something. It simply writes a value, and then waits for it to be reset by the PLC before it is available again. Note that this is only applicable when the PLC is programmed to reset the value after reading it. If your PLC expects the HMI to reset the bit, use the Momentary Button. Also note that this component is considered safer than the momentary button, because it receives positive feedback from the PLC that the signal was received, avoiding the timing dangers associated with a Momentary Button.

To use the latched button, bind an OPC tag bidirectionally to the latched button's Value property. When clicked, the button will write the value in its Set Value property to the Value property. Typically, Set Value is 1, and Value is 0 in a ready state, although the logic could be reversed or change simply by altering Set Value. The button can disable itself when it is writing, and will display different text. Note that the button considers itself to be writing whenever Value equals Set Value - you must make sure that the PLC resets this value, otherwise the button will remain in a writing state.

See also:
Bidirectional Bindings

Properties

Appearance

Font	Font of text of this component Scripting name `font` Data type Font
Foreground Color	The foreground color of the component. Scripting name `foreground` Data type Color
Background Color	The background color of the button. Scripting name `buttonBG` Data type Color
Background 3D?	Should this button have a 3d type background, or a flat color one?

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Scripting name	`background3D`
Data type	boolean
Flags	expert

Fill Area?

Controls whether or not this button's internal area is filled

Scripting name	`contentAreaFilled`
Data type	boolean
Flags	expert

Border Painted?

Should the border of this button be displayed?

Scripting name	`borderPainted`
Data type	boolean
Flags	expert

Image Path

The relative path of the image.

Scripting name	`path`
Data type	String
Flags	bindable

Disabled Image Path

The relative path of the image to be displayed when this component is not enabled.

Scripting name	`disabledPath`
Data type	String
Flags	expert

Icon-Text Spacing

The space (in pixels) between the icon (if any) and the text (if any)

Scripting name	`iconTextGap`
Data type	int

Styles

Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Rollover

If true, the button may indicate that the mouse is hovering over it.

Scripting name	`rolloverEnabled`
Data type	boolean
Flags	expert

Focusable

If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.

Scripting name	`focusable`
Data type	boolean
Flags	expert

Idle Text

The text of the button while its value is not being written

Scripting name	`normalText`
Data type	String
Flags	bindable

Writing Text

The text of the button while its vaule is being written

Scripting name	`writePendingText`
Data type	String
Flags	bindable

Disable While Writing

If true, the button will be disabled while it is writing.

Scripting name	`disableWhileWriting`

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Data type boolean

Confirm? If true, a confirmation box will be shown.

Scripting name `confirm`
Data type boolean

Confirm Text The message to ask the user if confirmation is turned on.

Scripting name `confirmText`
Data type String

Mnemonic A single letter that will activate the button using 'ALT-mnemonic'.

Scripting name `mnemonicChar`
Data type String
Flags expert

Common

Name The name of this component.

Scripting name `name`
Data type String
Flags bindable

Enabled If disabled, a component cannot be used.

Scripting name `componentEnabled`
Data type boolean

Visible If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Mouseover Text The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Border The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border
Flags expert

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Opaque

Is this button completely opaque? Most aren't, so this should usually be false.

Scripting name	`opaque`
Data type	boolean
Flags	expert

Data

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Value

The current value. Should be bound bi-directionally to a tag

Scripting name	`value`
Data type	int
Flags	bindable

Set Value

The value to set the control value to when the button is pushed.

Scripting name	`setValue`
Data type	int
Flags	bindable

Layout

Margin

The space between a button's text and its borders.

Scripting name	`margin`
Data type	Insets
Flags	expert

Horizontal Alignment

The horizontal alignment of the button's contents (text and/or image)

Scripting name	`horizontalAlignment`
Data type	int
Values	**2** Left
	0 Center
	4 Right
	10 Leading
	11 Trailing

Horizontal Text Position

The horizontal position of the button's text relative to its image

Scripting name	`horizontalTextPosition`
Data type	int
Flags	expert
Values	**2** Left
	0 Center
	4 Right
	10 Leading
	11 Trailing

Vertical Alignment

The vertical alignment of the button's contents (text and/or image)

Scripting name	`verticalAlignment`
Data type	int
Values	**1** Top
	0 Center
	3 Bottom

Vertical Text Position

The vertical position of the button's text relative to its image

Scripting name	`verticalTextPosition`
Data type	int

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Flags	expert
Values	1 Top 0 Center 3 Bottom

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- action
- focus
- propertyChange
- key

Scripting Functions

This component has no special scripting functions.

9.2.5 Momentary Button

Momentary Button waiting to be pressed

Activated Momentary Button

Description

Momentary buttons are used to set a value for either a fixed amount of time, or however long the button remains held down, whichever is longer. Once the button is released, or the minimum time expires, the value is reset.

The momentary button uses it's *Control Value* property to affect the underlying data. Typically, this property uses a bidirectional tag binding to an OPC tag. When pressed, it will write its *On Value* to *Control Value*. When released, it will either write *Off Value* to *Control Value* immediately, or wait until *On Time* has elapsed (since the pressed event).

The button's *Indicator Value*, which is typically bound to the same OPC tag as *Control Value*, is used to draw an "active" indication border around the button. This gives the operator positive feedback that the value has written successfully. It also lets an operator at one terminal know if an operator at a different terminal is using the button currently.

⚠ Note that you may want to use the Latched Button instead of the Momentary Button if you simply need to send a signal to a PLC, and the PLC is able to reset the value. This lets the PLC reset the value, avoiding the potential for the bit to be left high. This is possible with the Momentary Button if, for example, the power to the client was cut while the button was held down.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

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Foreground Color	The foreground color of the component. Scripting name `foreground` Data type Color
Background Color	 Scripting name `buttonBG` Data type Color
Background 3D?	Should this button have a 3d type background, or a flat color one? Scripting name `background3D` Data type boolean Flags expert
Fill Area?	Controls whether or not this button's internal area is filled Scripting name `contentAreaFilled` Data type boolean Flags expert
Rollover?	If true, the button may indicate that the mouse is hovering over it. Scripting name `rolloverEnabled` Data type boolean Flags expert
Text	Text of this component Scripting name `text` Data type String Flags bindable
Indicator Width	The width of the indication border that shows whether or not the indicator value is currently set. Scripting name `indicatorWidth` Data type int
On Color	The color of the indicator border when the indicator value is on. Scripting name `onColor` Data type Color
Off Color	The color of the indicator border when the indicator value is off Scripting name `offColor` Data type Color
Image Path	The relative path of the image. Scripting name `path` Data type String Flags bindable
Disabled Image Path	The relative path of the image to be displayed when this component is not enabled. Scripting name `disabledPath` Data type String Flags expert
Icon-Text Spacing	The space (in pixels) between the icon (if any) and the text (if any) Scripting name `iconTextGap` Data type int
Styles	Contains the component's styles

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Scripting name styles
Data type Dataset
Flags bindable | expert

Behavior

Mnemonic
A single letter that will activate the button using 'ALT-mnemonic'.
Scripting name mnemonicChar
Data type String

On Value
The value that will be written to the Control Value on mouse-down.
Scripting name onValue
Data type int

Off Value
The value that will be written to the Control Value on mouse-up
Scripting name offValue
Data type int

On Time
The minimum amount of time to keep the control value at the "On Value"
Scripting name onTime
Data type int

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name componentEnabled
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name toolTipText
Data type String

Border
The border surrounding this component.
Scripting name innerBorder
Data type Border

Cursor
The mouse cursor to use when hovering over this component.
Scripting name cursorCode
Data type int
Values
0 Default
1 Crosshair
2 Text
3 Wait
12 Hand
13 Move
4 SW Resize
5 SE Resize
6 NW Resize
7 NE Resize
8 N Resize

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9	S Resize
10	W Resize
11	E Resize

Data

Control Value

Bind this to the tag that you want to control. (Typically, this is bound to the same location as Indicator Value)

Scripting name	`controlValue`
Data type	int
Flags	bindable

Indicator Value

Bind this to the tag that indicates the current state of the control value. (Typically, this is bound to the same location as Control Value)

Scripting name	`indicatorValue`
Data type	int
Flags	bindable

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

Horizontal Alignment

The horizontal alignment of the button's contents (text and/or image)

Scripting name	`horizontalAlignment`
Data type	int
Values	
2	Left
0	Center
4	Right
10	Leading
11	Trailing

Horizontal Text Position

The horizontal position of the button's text relative to its image

Scripting name	`horizontalTextPosition`
Data type	int
Flags	expert
Values	
2	Left
0	Center
4	Right
10	Leading
11	Trailing

Vertical Alignment

The vertical alignment of the button's contents (text and/or image)

Scripting name	`verticalAlignment`
Data type	int
Values	
1	Top
0	Center
3	Bottom

Vertical Text Position

The vertical position of the button's text relative to its image

Scripting name	`verticalTextPosition`
Data type	int
Flags	expert
Values	
1	Top
0	Center
3	Bottom

Scripting

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Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- action
- focus
- propertyChange
- key

Scripting Functions

This component has no special scripting functions.

9.2.6 Toggle Button

The two states of a toggle button

Description

The toggle button represents a bit: on (selected) or off (not selected). Visually the button looks down or depressed when it is selected, and up when it is not selected. Logically, this component is very similar to the Check Box component. Note that for implementing a controls screen, the 2 State Toggle is usually more appropriate than this component.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color

Background Color — The background color for the button.

Scripting name	`buttonBG`
Data type	Color

Background 3D? — Should this button have a 3d type background, or a flat color one?

Scripting name	`background3D`
Data type	boolean
Flags	expert

Opaque — Set this to false if you want the button to be completely opaque.

Scripting name	`opaque`
Data type	boolean
Flags	expert

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Fill Area?
Controls whether or not this button's internal area is filled

Scripting name	`contentAreaFilled`
Data type	boolean
Flags	expert

Border Painted?
Should the border of this button be displayed?

Scripting name	`borderPainted`
Data type	boolean
Flags	expert

Rollover?
If true, the button may indicate that the mouse is hovering over it.

Scripting name	`rolloverEnabled`
Data type	boolean
Flags	expert

Label
Text displayed on this button.

Scripting name	`text`
Data type	String
Flags	bindable

Image Path
The relative path of the image.

Scripting name	`path`
Data type	String
Flags	bindable

Selected Image Path
The relative path of the image to be displayed when this component is selected (toggled on).

Scripting name	`selectedPath`
Data type	String

Styles
Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Focusable
If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.

Scripting name	`focusable`
Data type	boolean
Flags	expert

Common

Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled
If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border
The border surrounding this component. NOTE that the border is

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unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Selected — State of this tToggle button.

Scripting name `selected`
Data type boolean
Flags bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Layout

Margin — The space between a button's text and its borders.

Scripting name `margin`
Data type Insets
Flags expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- item
- action
- focus
- propertyChange
- key

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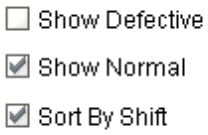
Scripting Functions

This component has no special scripting functions.

9.2.7 Check Box



Description

A CheckBox is a familiar component that represents a bit - it is either on (selected) or off (not selected). It is functionally equivalent to the Toggle Button component.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

Text — The text displayed on the checkbox.

Scripting name	`text`
Data type	String
Flags	bindable

Margin — The internal margin that provides padding for the contents of this button.

Scripting name	`margin`
Data type	Insets
Flags	expert

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Rollover — If true, the button may indicate that the mouse is hovering over it.

Scripting name	`rolloverEnabled`
Data type	boolean
Flags	expert

Focusable — If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.

Scripting name	`focusable`
Data type	boolean
Flags	expert

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Common

Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled
If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Opaque
If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	`opaque`
Data type	boolean

Cursor
The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default
	1 Crosshair
	2 Text
	3 Wait
	12 Hand
	13 Move
	4 SW Resize
	5 SE Resize
	6 NW Resize
	7 NE Resize
	8 N Resize
	9 S Resize
	10 W Resize
	11 E Resize

Data

Selected
The current state of the checkbox.

Scripting name	`selected`
Data type	boolean
Flags	bindable

Data Quality
The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

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Horizontal Alignment — The horizontal alignment of the button's contents (text and/or image)

Scripting name	`horizontalAlignment`
Data type	int
Values	`2` Left `0` Center `4` Right `10` Leading `11` Trailing

Vertical Alignment — The vertical alignment of the button's contents (text and/or image)

Scripting name	`verticalAlignment`
Data type	int
Values	`1` Top `0` Center `3` Bottom

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
item
action
focus
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.2.8 Radio Button

Description

The radio button is similar to the CheckBox component, except for one special property. All radio buttons in the same Container (including the Root Container) will automatically be mutually exclusive. This means that only one radio button can be selected at a time. Radio buttons are a good way to let the user choose just one of a number of options. Dropdown Lists are another good way to do this.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`

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Data type	Color

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

Text — Text of this component

Scripting name	`text`
Data type	String
Flags	bindable

Margin — The internal margin that provides padding for the contents of this button.

Scripting name	`margin`
Data type	Insets
Flags	expert

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Rollover — If true, the button may indicate that the mouse is hovering over it.

Scripting name	`rolloverEnabled`
Data type	boolean
Flags	expert

Focusable — If a button is not focusable, you will not be able to interact with it with the keyboard. This means you can't "tab" over to it.

Scripting name	`focusable`
Data type	boolean
Flags	expert

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled — If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

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Scripting name `opaque`
Data type boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
- 0 Default
- 1 Crosshair
- 2 Text
- 3 Wait
- 12 Hand
- 13 Move
- 4 SW Resize
- 5 SE Resize
- 6 NW Resize
- 7 NE Resize
- 8 N Resize
- 9 S Resize
- 10 W Resize
- 11 E Resize

Data

Selected — The current state of the RadioButton.

Scripting name `selected`
Data type boolean
Flags bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Layout

Horizontal Alignment — The horizontal alignment of the button's contents (text and/or image)

Scripting name `horizontalAlignment`
Data type int
Values
- 2 Left
- 0 Center
- 4 Right
- 10 Leading
- 11 Trailing

Vertical Alignment — The vertical alignment of the button's contents (text and/or image)

Scripting name `verticalAlignment`
Data type int
Values
- 1 Top
- 0 Center
- 3 Bottom

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- item
- action
- focus

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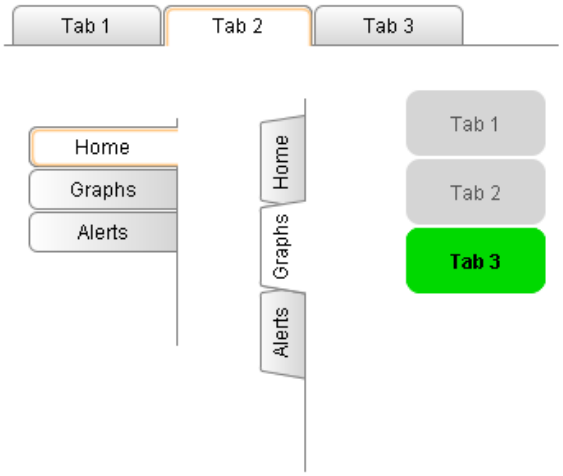
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.2.9 Tab Strip



Tab strips are highly customizable.

Description

In general, a tab strip is just a single-selection multiple choice component. In practice it is used anywhere that a user needs to be able to select between multiple windows or screens. It is most commonly used in a docked window to provide automatic window navigation. To support this typical use-case, the tab strip has two navigation modes:

1. **Swap to Window.** *(default)* The tab strip will automatically call `system.nav.swapTo()` with the name of the selected tab. This facilitates very easy navigation for most common projects.
2. **Disabled.** The tab strip doesn't do anything when the tab selection changes. Users can implement their own via property bindings or by responding to the `propertyChange` scripting event.

The tab strips visual style is highly customizable. There are different rendering styles, and things such as fonts, colors, line thicknesses, hover colors, and gradients are customizable within each rendering style. Use the Tab Strip's customizer to come up with a style that suits your project, as well as to manage the tabs that are present. The tabs and their styles are all stored in a dataset property (called *Tab Data*), so they can be modified at runtime as well.

See also:
Typical Navigation Strategy

Properties

Appearance

Background Color — The background color of the component.
Scripting name `background`

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Data type Color

Orientation

Orientation of the tab strip.

Scripting name `orientation`
Data type int
Values
0 Top
1 Left
2 Bottom
3 Right

Selected Tab

Name of the selected tab. This is also the name of the window that, if it exists, will be swapped to when this tab is pressed.

Scripting name `selectedTab`
Data type String
Flags bindable

Renderer

The renderer to use when rendering tabs.

Scripting name `renderer`
Data type int
Values
0 Simple
1 Fancy
2 Folder

Size Mode

The sizing mode tabs use when deciding their size. Automatic means every tab is the same fixed size. Individual lets each tab decide its own size based on the size of its text.

Scripting name `sizeMode`
Data type int
Values
0 Automatic
1 Individual

Intertab Space

The amount of space between each tab.

Scripting name `interTabSpace`
Data type int

Text Padding

Padding on each side of the text inside a tab.

Scripting name `textPadding`
Data type int

Rounding Radius

Rounding radius for the tab corners.

Scripting name `roundingRadius`
Data type int

Separator Thickness

Thickness of the line drawn across the bottom and around each tab.

Scripting name `separatorThickness`
Data type float

Separator Color

Color of the line drawn across the bottom and around each tab.

Scripting name `separatorColor`
Data type Color

Antialias

Draw with antialias on? Makes text smoother

Scripting name `antialias`
Data type boolean
Flags expert

Styles

Contains the component's styles

Scripting name `styles`
Data type Dataset

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Flags bindable | expert

Behavior

Navigation Mode

Navigation mode. Disabled does nothing when a tab is pressed. Swap to window swaps to the window whose name corresponds to the name of the selected tab, provided that window exists.

Scripting name `navigationMode`
Data type int
Values
`0` Disabled
`1` Swap to window

Common

Name

The name of this component.

Scripting name `name`
Data type String
Flags bindable

Enabled

If disabled, a component cannot be used.

Scripting name `componentEnabled`
Data type boolean

Visible

If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Cursor

The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize
`8` N Resize
`9` S Resize
`10` W Resize
`11` E Resize

Data

Tab Data

Tab Data.

Scripting name `tabData`
Data type Dataset

Data Quality

The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

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Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3 Display

9.3.1 Label

Description

The Label is one of the most versatile components. It can display text, images, or both. Its text can be HTML formatted (like most components). It can even be made to respond to user interaction through its events.

Labels are one of the most common components that you will want to add *dynamic properties* to. For instance, you can put an integer dynamic property "state" on a label, and then bind the text to be "On" when the state=1 and "Off" otherwise, using an expression binding. Bind the background color to be red when the state is 0, and green when the state is 1 using a property binding. Now you have a re-usable binary state indicator. While you could have used the Multi-State Indicator to achieve the same effect, the exercise is good practice for creating custom components. You can see how the flexibility of bindings and dynamic properties make the Label extremely versatile.

See also:
Dynamic Properties
Property Bindings

Properties

Appearance

Font	Font of text of this component

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Scripting name	font
Data type	Font

Fill Background

If true, the label's background color will be drawn. If false, it will have a transparent background.

Scripting name	fillBackground
Data type	boolean
Flags	bindable

Foreground Color

The color of the Label's text.

Scripting name	foreground
Data type	Color
Flags	bindable

Background Color

The background color of the label, if opaque is set to "true".

Scripting name	background
Data type	Color
Flags	bindable

Image Path

The relative path of the image.

Scripting name	path
Data type	String
Flags	bindable

Disabled Image Path

The relative path of the image to be displayed when this component is not enabled.

Scripting name	disabledPath
Data type	String
Flags	expert

Icon-Text Spacing

The space (in pixels) between the icon (if any) and the text (if any)

Scripting name	iconTextGap
Data type	int

Rotation

The angle of rotation in degrees.

Scripting name	rotation
Data type	int

Antialias

Draw with antialias on? Makes text smoother

Scripting name	antialias
Data type	boolean
Flags	expert

Styles

Contains the component's styles

Scripting name	styles
Data type	Dataset
Flags	bindable | expert

Common

Name

The name of this component.

Scripting name	name
Data type	String
Flags	bindable

Enabled

If disabled, a component cannot be used.

Scripting name	componentEnabled
Data type	boolean

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Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Text — Text of this Label

Scripting name	`text`
Data type	String
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

Horizontal Alignment — Determines the alignment of the label's contents along the X axis

Scripting name	`horizontalAlignment`
Data type	int
Values	**2** Left **0** Center **4** Right **10** Leading **11** Trailing

Horizontal Text Position — Determines the horizontal position of the label's text, relative to its image

Scripting name	`horizontalTextPosition`
Data type	int

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Values	2	Left
	0	Center
	4	Right
	10	Leading
	11	Trailing

Vertical Alignment — Determines the alignment of the label's contents along the Y axis

Scripting name	`verticalAlignment`
Data type	int
Values	1 Top
	0 Center
	3 Bottom

Vertical Text Position — Determines the vertical position of the label's text, relative to its image

Scripting name	`verticalTextPosition`
Data type	int
Values	1 Top
	0 Center
	3 Bottom

Scripting

Events

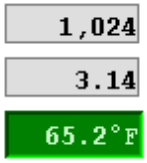
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.2 Numeric Label



Description

This component is a specialized label designed to display a number. It can include units, and has an integrated number format string. By default the number is displayed bold and the units are not. This can be customized, see the Prefix and Suffix expert properties. This label's text is constructed as follows:

```
Prefix + numberFormat(Value, Pattern) + Suffix + Units
```

It is important to note that you could customize the standard Label component using custom properties and bindings to mimic this component exactly. If this component doesn't do something that you need, you can make your own numeric label and use it everywhere in your project.

Properties

Appearance

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Font	Font of text of this component
Scripting name	`font`
Data type	Font
Foreground Color	The foreground color of the component.
Scripting name	`foreground`
Data type	Color
Flags	bindable
Background Color	The background color of the component.
Scripting name	`background`
Data type	Color
Flags	bindable
Number Format Pattern	The number formatting string used to format the value.
Scripting name	`pattern`
Data type	String
Image Path	The relative path of the image.
Scripting name	`path`
Data type	String
Flags	bindable
Disabled Image Path	The relative path of the image to be displayed when this component is not enabled.
Scripting name	`disabledPath`
Data type	String
Flags	expert
Icon-Text Spacing	The space (in pixels) between the icon (if any) and the text (if any)
Scripting name	`iconTextGap`
Data type	int
Rotation	The angle of rotation in degrees.
Scripting name	`rotation`
Data type	int
Antialias	Draw with antialias on? Makes text smoother
Scripting name	`antialias`
Data type	boolean
Flags	expert
Styles	Contains the component's styles
Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Common

Name	The name of this component.
Scripting name	`name`
Data type	String
Flags	bindable
Enabled	If disabled, a component cannot be used.
Scripting name	`componentEnabled`
Data type	boolean

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Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	`opaque`
Data type	boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Value — The numeric value of this label.

Scripting name	`value`
Data type	double
Flags	bindable

Units — The engineering units to display after the number.

Scripting name	`units`
Data type	String

Prefix — A string that will be placed before the number.

Scripting name	`prefix`
Data type	String
Flags	expert

Suffix — A string that will be placed after the number, and before the units.

Scripting name	`suffix`
Data type	String
Flags	expert

Data Quality — The data quality code for any tag bindings on this component.

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Scripting name `dataQuality`
Data type int
Flags bindable | expert

Layout

Horizontal Alignment — Determines the alignment of the label's contents along the X axis

Scripting name `horizontalAlignment`
Data type int
Values
`2` Left
`0` Center
`4` Right
`10` Leading
`11` Trailing

Horizontal Text Position — Determines the horizontal position of the label's text, relative to its image

Scripting name `horizontalTextPosition`
Data type int
Flags expert
Values
`2` Left
`0` Center
`4` Right
`10` Leading
`11` Trailing

Vertical Alignment — Determines the alignment of the label's contents along the Y axis

Scripting name `verticalAlignment`
Data type int
Values
`1` Top
`0` Center
`3` Bottom

Vertical Text Position — Determines the vertical position of the label's text, relative to its image

Scripting name `verticalTextPosition`
Data type int
Flags expert
Values
`1` Top
`0` Center
`3` Bottom

Uncategorized

Text — Text of this Label

Scripting name `text`
Data type String
Flags bindable | read-only

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

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9.3.3 Multi-State Indicator

Description

This component is a specialized label used to display a discrete state. The state must be represented by an integer, but the values and number of different states is customizable. Use the component's styles customizer to configure the different states.

See also:
Component Styles

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color
Flags	bindable

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color
Flags	bindable

Image Path — The relative path of the image.

Scripting name	`path`
Data type	String
Flags	bindable

Disabled Image Path — The relative path of the image to be displayed when this component is not enabled.

Scripting name	`disabledPath`
Data type	String
Flags	expert

Icon-Text Spacing — The space (in pixels) between the icon (if any) and the text (if any)

Scripting name	`iconTextGap`
Data type	int

Antialias — Draw with antialias on? Makes text smoother

Scripting name	`antialias`
Data type	boolean
Flags	expert

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

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Common

Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled
If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor
The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default
	1 Crosshair
	2 Text
	3 Wait
	12 Hand
	13 Move
	4 SW Resize
	5 SE Resize
	6 NW Resize
	7 NE Resize
	8 N Resize
	9 S Resize
	10 W Resize
	11 E Resize

Data

State
The current state of the component.

Scripting name	`state`
Data type	int
Flags	bindable

Text
Text of this Label

Scripting name	`text`
Data type	String
Flags	bindable

Data Quality
The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

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Layout

Horizontal Alignment — Determines the alignment of the label's contents along the X axis

Scripting name	`horizontalAlignment`
Data type	int
Values	**2** Left **0** Center **4** Right **10** Leading **11** Trailing

Horizontal Text Position — Determines the horizontal position of the label's text, relative to its image

Scripting name	`horizontalTextPosition`
Data type	int
Flags	expert
Values	**2** Left **0** Center **4** Right **10** Leading **11** Trailing

Vertical Alignment — Determines the alignment of the label's contents along the Y axis

Scripting name	`verticalAlignment`
Data type	int
Values	**1** Top **0** Center **3** Bottom

Vertical Text Position — Determines the vertical position of the label's text, relative to its image

Scripting name	`verticalTextPosition`
Data type	int
Flags	expert
Values	**1** Top **0** Center **3** Bottom

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.4 LED Display

Description

The LED display is a stylized numeric or alphanumeric label. It has three different visual styles which

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all correspond to a kind of physical display: 7-segment, 14-segment, and 5x7 matrix. By default this component is in numeric mode, which means you should use its *Value* property. If you need to display characters as well, switch the mode to alphanumeric, and use the *Text* property.

Properties

Appearance

Style — The visual style of the display.

Scripting name	`style`
Data type	int
Values	**7** 7 Segment **14** 14 Segment **34** 5x7 Matrix

Background Color — The color of the background

Scripting name	`background`
Data type	Color

LED Lit — The color of lit LED segments

Scripting name	`glyphForeground`
Data type	Color

LED Unlit — The color of unlit LED segments

Scripting name	`glyphBackground`
Data type	Color

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Mode — The mode of the display.

Scripting name	`mode`
Data type	int
Values	**0** Numeric **1** Alphanumeric

Number Format Pattern — The number formatting string used to format the value.

Scripting name	`numberFormat`
Data type	String

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

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Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default
	1 Crosshair
	2 Text
	3 Wait
	12 Hand
	13 Move
	4 SW Resize
	5 SE Resize
	6 NW Resize
	7 NE Resize
	8 N Resize
	9 S Resize
	10 W Resize
	11 E Resize

Data

Value

The numeric value of the display, used when Mode is Numeric

Scripting name	`value`
Data type	double
Flags	bindable

Text

The text value of the display, used when Mode is Alphanumeric

Scripting name	`text`
Data type	String
Flags	bindable

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Layout

Horizontal Alignment

Determines the alignment of the display's contents along the X axis

Scripting name	`horizontalAlignment`
Data type	int
Values	**2** Left
	0 Center
	4 Right

Letter Gap

The percentage of the height to be used as an inter-character spacing

Scripting name	`gap`
Data type	float
Flags	expert

Margin

The margin for the interior of the display

Scripting name	`margin`
Data type	Insets
Flags	expert

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Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.5 Moving Analog Indicator

Description

Description missing.

Properties

Appearance

Show Value — Show the current value above or beneath the value indicator.

Scripting name: `showValue`
Data type: boolean

Value Format — The string format for the value, if it is shown.

Scripting name: `valueFormat`
Data type: String

Value Font — The font for the value label.

Scripting name: `font`
Data type: Font

Range Fill — The background color of the range strip.

Scripting name: `rangeFill`
Data type: Color

Range Stroke — The stroke color for the range strip.

Scripting name: `rangeStroke`
Data type: Color

Desired Range Color — The color of the desired range.

Scripting name: `desiredRangeColor`
Data type: Color

Inactive Alarm Color — The color of inactive alarm range.

Scripting name: `inactiveAlarmColor`
Data type: Color

Level 2 Alarm Color — The color of an active level 2 alarm (Hi or Lo).

Scripting name: `level2AlarmColor`
Data type: Color

Level 1 Alarm Color — The color of an active level 1 alarm (Hi-Hi or Lo-Lo)

Scripting name: `level1AlarmColor`
Data type: Color

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Interlock Color
The color of the interlock range.
Scripting name `interlockColor`
Data type Color

Value Indicator Fill
The fill color of the value indicator.
Scripting name `valueFill`
Data type Color

Value Indicator Stroke
The stroke color of the value indicator.
Scripting name `valueStroke`
Data type Color

Setpoint Fill
The fill color of the setpoint indicator.
Scripting name `setpointFill`
Data type Color

Setpoint Stroke
The stroke color of the setpoint indicator.
Scripting name `setpointStroke`
Data type Color

Stroke Width
The stroke width for lines drawn.
Scripting name `strokeWidth`
Data type float
Flags expert

Reverse Indicator
Put the indicator triangle on the other side of the track.
Scripting name `reverseIndicatorLocation`
Data type boolean
Flags expert

Styles
Contains the component's styles
Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name `cursorCode`

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Data type	int
Values	0 Default 1 Crosshair 2 Text 3 Wait 12 Hand 13 Move 4 SW Resize 5 SE Resize 6 NW Resize 7 NE Resize 8 N Resize 9 S Resize 10 W Resize 11 E Resize

Data

Range High — The overall high value for the display

Scripting name	`rangeHi`
Data type	double
Flags	bindable

Range Low — The overall low value for the display.

Scripting name	`rangeLo`
Data type	double
Flags	bindable

Process Value — The current value of the process.

Scripting name	`processValue`
Data type	Double

Setpoint Value — The current value of the setpoint.

Scripting name	`setpointValue`
Data type	Double

High Interlock — The value above which an interlock will be activated

Scripting name	`hiInterlock`
Data type	Double
Flags	bindable

High High Alarm — The value above which is a high-high alarm.

Scripting name	`hihiAlarm`
Data type	Double
Flags	bindable

High Alarm — The value above which is a high alarm.

Scripting name	`hiAlarm`
Data type	Double
Flags	bindable

Desired High — The upper value of the desired operating range.

Scripting name	`desiredHi`
Data type	Double
Flags	bindable

Desired Low — The lower value of the desired operating range.

Scripting name	`desiredLo`
Data type	Double
Flags	bindable

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Low Alarm
The value below which is a low alarm.
Scripting name `loAlarm`
Data type Double
Flags bindable

Low Low Alarm
The value below which is a low-low alarm.
Scripting name `loloAlarm`
Data type Double
Flags bindable

Low Interlock
The value below which an interlock will be activated.
Scripting name `loInterlock`
Data type Double
Flags bindable

Hi Alarm Active
True when the process value is greater than the hi alarm threshold
Scripting name `hiAlarmActive`
Data type boolean
Flags bindable | read-only

Hi-Hi Alarm Active
True when the process value is greater than the hi-hi alarm threshold
Scripting name `hihiAlarmActive`
Data type boolean
Flags bindable | read-only

Hi Interlock Active
True when the process value is greater than the hi interlock threshold
Scripting name `hiInterlockActive`
Data type boolean
Flags bindable | read-only

Lo Alarm Active
True when the process value is less than the lo alarm threshold
Scripting name `loAlarmActive`
Data type boolean
Flags bindable | read-only

Lo-Lo Alarm Active
True when the process value is less than the lo-lo alarm threshold
Scripting name `loloAlarmActive`
Data type boolean
Flags bindable | read-only

Lo Interlock Active
True when the process value is less than the lo interlock threshold
Scripting name `loInterlockActive`
Data type boolean
Flags bindable | read-only

Data Quality
The data quality code for any tag bindings on this component.
Scripting name `dataQuality`
Data type int
Flags bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

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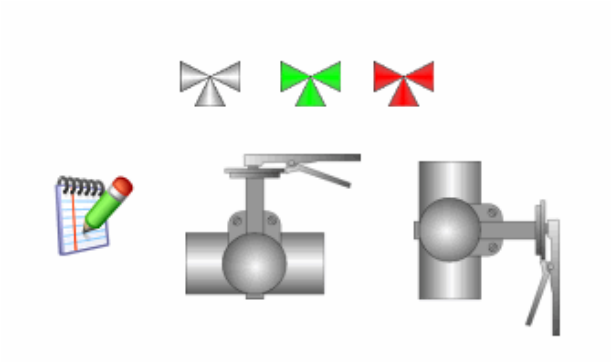
Scripting Functions

This component has no special scripting functions.

9.3.6 Image



Description

The image component is a deceptively powerful component. While you can use other components, like the Label, to display images as well, this component gives you much more flexibility. In particular, this component has 4 important features for displaying images:

1. **Scaling.**
2. **Rotation.** You can use rotation to create spinning animations by binding it to a Timer component.
3. **Color Tinting.** Dynamically apply a color tint to an image to allow it to display realtime status.
4. **Color Swapping**. Use color swapping to change one specific color in an image to another, on the fly. Also used for realtime status display.

To choose an image, simply press the browse button ( ) next to this component's *Image Path* property. You can drag new images (*.png, *.gif, *.jpg, *.bmp) into the Image Management window to upload them.

Images are stored on the Gateway, *not* in your window or project. This means that you can alter an image globally, and it will affect all windows in all projects. It also means that you must be careful to migrate custom images if you do project backups (as opposed to Gateway backups, which will automatically include both projects and images)

Properties

Appearance

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled — If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

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Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Image Path — The relative path of the image.

Scripting name	`path`
Data type	String
Flags	bindable

Disabled Image Path — The relative path of the image to be displayed when this component is not enabled.

Scripting name	`disabledPath`
Data type	String
Flags	expert

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Image Manipulation

Stretch Mode — Sets the stretch mode for this image.

Scripting name	`stretchMode`
Data type	int
Values	**0** No Stretch **1** Bounds **3** % Bounds **2** Parameters

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Stretch Width	If stretch mode is "Parameters", this will be the stretched width of the image If stretch mode is "% Bounds", this will be the percentage of the component's width. Scripting name `stretchWidth` Data type int Flags bindable
Stretch Height	If stretch mode is "Parameters", this will be the stretched height of the image If stretch mode is "% Bounds", this will be the percentage of the component's height. Scripting name `stretchHeight` Data type int Flags bindable
Color Swap Filter	Swap a specific color to another. Scripting name `useColorSwap` Data type boolean Flags bindable
Swap From	If the Color Swap Filter is on, this color will be changed to the Swap To color. Scripting name `swapFromColor` Data type Color Flags bindable
Swap To	If the Color Swap Filter is on, the Swap From color will be changed to this color. Scripting name `swapToColor` Data type Color Flags bindable
Swap Threshold	Threshold (0-255) for the swap from color matching. 0 is no tolerance, 255 is max tolerance. Scripting name `swapThreshold` Data type int Flags expert
Tint Filter	Tint the entire image a color (works best with greyscale images) Scripting name `useTint` Data type boolean Flags bindable
Tint Color	If the Tint Filter is on, this is the color of the tint. Scripting name `tintColor` Data type Color Flags bindable
Flip Horizontal	Flip (mirror) the image horizontally. Scripting name `flipHorizontal` Data type boolean
Flip Vertical	Flip (mirror) the image vertically. Scripting name `flipVertical` Data type boolean

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Rotation	The angle of rotation in degrees. Scripting name `rotation` Data type int

Scripting

Events

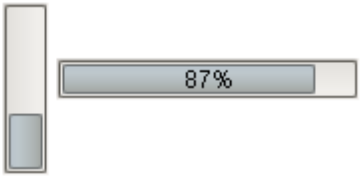
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.7 Progress Bar



Description

Visually indicates the progress of some task. Can be used to display any value that has an upper and lower bound.

Properties

Appearance

Font	Font of text of this component Scripting name `font` Data type Font
Foreground Color	The foreground color of the component. Scripting name `foreground` Data type Color
Background Color	The background color of the component. Scripting name `background` Data type Color
Horizontal?	If true, the progress bar will display horizontally, else it will display vertically Scripting name `horizontal` Data type boolean
Show Percentage?	If true, the progress bar will display its percentage. Scripting name `stringPainted` Data type boolean
Direction	Determines the direction of progress for this progress bar. Scripting name `direction` Data type int

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Flags	expert
Values	0 Left to Right 1 Right to Left

Styles — Contains the component's styles

Scripting name	styles
Data type	Dataset
Flags	bindable | expert

Behavior

Indeterminate? — When true, the progressbar displays animation indicating that something is happening, but it will take an indeterminate amount of time

Scripting name	indeterminate
Data type	boolean
Flags	bindable

Common

Name — The name of this component.

Scripting name	name
Data type	String
Flags	bindable

Enabled — If disabled, a component cannot be used.

Scripting name	componentEnabled
Data type	boolean

Visible — If disabled, the component will be hidden.

Scripting name	visible
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	border
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	toolTipText
Data type	String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	opaque
Data type	boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	cursorCode
Data type	int
Values	0 Default 1 Crosshair 2 Text 3 Wait 12 Hand 13 Move 4 SW Resize 5 SE Resize 6 NW Resize 7 NE Resize 8 N Resize 9 S Resize

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10 W Resize
11 E Resize

Data

Value — The current state of the Progress Bar.

Scripting name	`value`
Data type	int
Flags	bindable

Maximum — The maximum value that this progress bar will reach

Scripting name	`maximum`
Data type	int
Flags	bindable

Minimum — The minimum value that this progress bar will reach

Scripting name	`minimum`
Data type	int
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

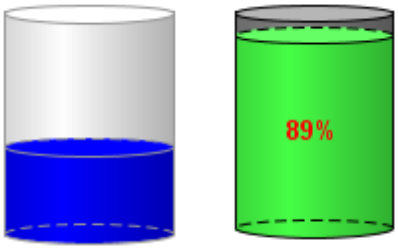
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.8 Cylindrical Tank



Description

A component that looks like a 3D cylindrical tank, with some liquid inside. The liquid rises and falls as the *Value* property changes.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`

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Data type Font

Foreground Color — The foreground color of the component.
Scripting name foreground
Data type Color

Background Color — The background color of the component.
Scripting name background
Data type Color

Rotation — The angle of rotation in degrees.
Scripting name rotation
Data type int

Anti Alias — Draw component using anti-aliasing?
Scripting name antiAlias
Data type boolean
Flags expert

Units — Units of measure for tank contents
Scripting name units
Data type String

Show Value — Show numeric value, capacity, and units?
Scripting name showValue
Data type boolean

Show Percentage — Show percentage of tank filled?
Scripting name showPercent
Data type boolean

Font Color — The color of the value and/or percentage labels.
Scripting name fontColor
Data type Color

Tank Color — Color of the non-filled tank section
Scripting name tankColor
Data type Color
Flags bindable

Liquid Color — Color of the filled tank section
Scripting name liquidColor
Data type Color
Flags bindable

Styles — Contains the component's styles
Scripting name styles
Data type Dataset
Flags bindable | expert

Common

Name — The name of this component.
Scripting name name
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.
Scripting name visible

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Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name `cursorCode`
Data type int
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize
`8` N Resize
`9` S Resize
`10` W Resize
`11` E Resize

Data

Value
Numeric value of tank's level
Scripting name `value`
Data type int
Flags bindable

Capacity
Total capacity of tank
Scripting name `capacity`
Data type int
Flags bindable

Data Quality
The data quality code for any tag bindings on this component.
Scripting name `dataQuality`
Data type int
Flags bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

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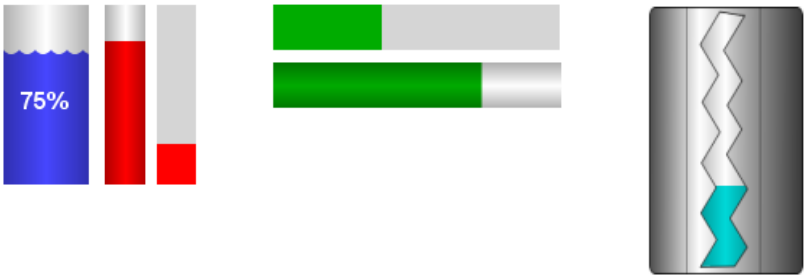
9.3.9 Level Indicator



Description

A component that displays the level of fullness of some container. This is basically a visually simplified version of the Cylindrical Tank component. By turning on and off the Gradient and Liquid Waves properties, you can control how fancy this component looks. This component is well suited to be put behind images of tanks with transparent cutaways.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Units — Units of measure for tank contents

Scripting name	`units`
Data type	String

Show Value — Show numeric value, capacity, and units?

Scripting name	`showValue`
Data type	boolean

Show Percentage — Show percentage of tank filled?

Scripting name	`showPercent`
Data type	boolean

Orientation — Determines which way the level "grows" for an increase in value

Scripting name	`orientation`
Data type	int
Values	**0** Bottom to Top **1** Left to Right **2** Top to Bottom **3** Right to Left

Filled Color — Set the color of filled portion.

Scripting name	`foreground`
Data type	Color

Background Color — The color of the background.

Scripting name	`background`
Data type	Color

Gradient — Draw level as 3D gradient?.

Scripting name	`gradient`
Data type	boolean

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Liquid Waves — Draw liquid 'waves'?

Scripting name	`waves`
Data type	boolean

Wave Length — The length of each 'wave'

Scripting name	`waveLength`
Data type	int
Flags	expert

Wave Height — The height of each 'wave'

Scripting name	`waveHeight`
Data type	int
Flags	expert

Font Color

Scripting name	`fontColor`
Data type	Color

Anti Alias — Draw component using anti-aliasing?

Scripting name	`antiAlias`
Data type	boolean
Flags	expert

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize

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5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Value	Numeric value of tank's level	
	Scripting name	`value`
	Data type	int
	Flags	bindable
Capacity	Total capacity of tank	
	Scripting name	`capacity`
	Data type	int
	Flags	bindable
Data Quality	The data quality code for any tag bindings on this component.	
	Scripting name	`dataQuality`
	Data type	int
	Flags	bindable | expert

Scripting

Events

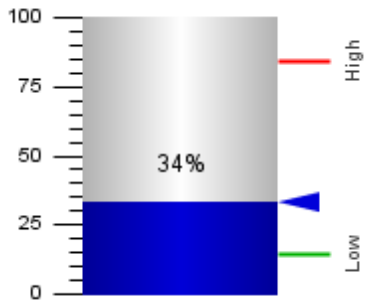
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.10 Linear Scale



Two linear scales flanking a level indicator

Description

The linear scale component has two main purposes. The first is to display a series of tick marks and labels that visually represent a linear range between a minimum value and a maximum value. The second purpose is to display indicators that represent a value or range of values, correctly positioned

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in on the linear scale. In the example above, two linear scales are used to flank a level indicator. The scale on the left has only tick marks, and no indicators. The scale on the right is used to display three indicators and no tick marks.

To configure the indicators, you use the Linea Scale's "Scale Indicators" customizer. To configure the tick marks, you use the scale's various properties that determine the minimum value, maximum value, and the various tick mark spans.

Properties

Appearance

Mirror
Mirror the scale so it paints against the opposite edge.

Scripting name	`mirror`
Data type	boolean

Reverse Range
Reverse the scale so that values go from high to low instead of low to high.

Scripting name	`reverseRange`
Data type	boolean

Label Angle
Changes the angle that the labels are drawn

Scripting name	`labelAngle`
Data type	int
Values	**0** Right **90** Down **180** Left **270** Up

Margin
The margin to leave blank as a percentage of the total height or width of the scale.

Scripting name	`margin`
Data type	double

Major Tick Length
The line length for major ticks, in pixels.

Scripting name	`majorTickLength`
Data type	double

Major Tick Thickness
The line thickness for major ticks, in pixels.

Scripting name	`majorTickStroke`
Data type	float

Major Tick Color
The line color for major ticks

Scripting name	`majorTickColor`
Data type	Color

Label Format
The label format string. Examples: "%.1f" will render numbers like "15.0", "%.0f" will render numbers like "15". Using the empty string "" will disable the labels.

Scripting name	`majorTickLabelFormat`
Data type	String

Label Font
The font used for drawing tick labels.

Scripting name	`majorTickFont`
Data type	Font

Label Color
The color used for drawing tick labels.

Scripting name	`majorTickLabelColor`

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Data type Color

Minor Tick Length
The line length for minor ticks, in pixels.
Scripting name `minorTickLength`
Data type double

Minor Tick Thickness
The line thickness for minor ticks, in pixels
Scripting name `minorTickStroke`
Data type float

Minor Tick Color
The line color for minor ticks.
Scripting name `minorTickColor`
Data type Color

Fine Tick Length
The line length for fine ticks, in pixels.
Scripting name `fineTickLength`
Data type double

Fine Tick Thickness
The line thickness for fine ticks, in pixels
Scripting name `fineTickStroke`
Data type float

Fine Tick Color
The line color for fine ticks.
Scripting name `fineTickColor`
Data type Color

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name `cursorCode`
Data type int
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize

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8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Min Value — The lower bound of the scale

Scripting name	`minValue`
Data type	double
Flags	bindable

Max Value — The upper bound of the scale

Scripting name	`maxValue`
Data type	double
Flags	bindable

Major Tick Span — The span length for major ticks. Should be a multiple of the minor and fine tick spans.

Scripting name	`majorTickSpan`
Data type	double

Minor Tick Span — The span length for minor ticks. Should be a factor of the major tick span and a multiple of the fine tick spans. Use zero to disable minor ticks.

Scripting name	`minorTickSpan`
Data type	double

Fine Tick Span — The span length for fine ticks. Should be a factor of the major and minor tick spans. Use zero to disable fine ticks.

Scripting name	`fineTickSpan`
Data type	double

Indicators — This dataset stores the indicators (if any) for the scale.

Scripting name	`indicators`
Data type	Dataset

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

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9.3.11 Barcode

Description

The barcode component displays some text as a barcode. The supported formats are:
- Code 128
- Code 39
- Extended Code 39
- Codabar
- Interleaved Code 25
- MSI
- EAN-13
- EAN-8

See also:
system.print.createPrintJob

Properties

Appearance

Font — Font of text of this component
Scripting name: `font`
Data type: Font

Foreground Color — The foreground color of the component.
Scripting name: `foreground`
Data type: Color

Background Color — The background color of the component.
Scripting name: `background`
Data type: Color

Barcode Background — The background color of the actual barcode
Scripting name: `barcodeBackground`
Data type: Color

Show Text? — If true, the code is displayed in human-readable text beneath the barcode
Scripting name: `showText`
Data type: boolean

Barcode Height — The height of the barcode
Scripting name: `barcodeHeight`
Data type: int

Narrowest Bar Width — The width (in pixels) of the narrowest bar.
Scripting name: `narrowestBarWidth`
Data type: int

Rotation — The angle of rotation in degrees.
Scripting name: `angleDegrees`

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Data type int
Flags expert

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Data

Code — The code string that is converted into a barcode to display

Scripting name `code`
Data type String
Flags bindable

Barcode Format — The barcode format to display.

Scripting name `barcodeType`
Data type int
Values
- `0` Code 39
- `1` Code 39 (narrow)
- `2` Extended Code 39
- `3` Extended Code 39 (narrow)
- `4` Code 128
- `5` Codabar
- `6` Codabar (narrow)
- `7` Interleaved Code 25
- `8` Interleaved Code 25 (narrow)
- `9` MSI
- `10` EAN-13
- `11` EAN-8

Check Digit — Include Check Digit?

Scripting name `checkDigit`
Data type boolean

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

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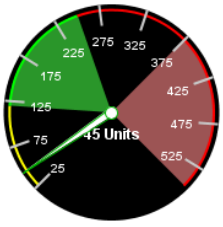
mouse
mouseMotion
propertyChange

Scripting Functions

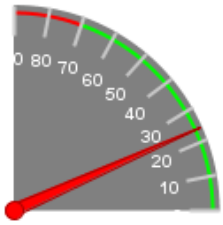
This component has no special scripting functions.

9.3.12 Meter



Meters have customizable segments

A few gradient and transparent circles can give your meter some shine



Meters can be many shapes

Description

A meter display shows a value on a needle-gauge. The gauge's range can be broken up into five intervals. The intervals can have their own edge and background colors.

How the meter looks is affected by its appearance properties. You can modify colors, thicknesses, start and extend angles, needle size, etc to get the meter that you want. For example, the meter on the far right of the example has a Meter Angle Extent of 90°, a Meter Angle of 45°, a reversed range, and 2 intervals.

Properties

Appearance

Units	A string to describe the units for the current value label. Scripting name `units` Data type String
Dial Background	The background color of the dial face. Scripting name `dialBackground` Data type Color
Needle Color	The color of the meter's needle. Scripting name `needleColor` Data type Color
Needle Size	The size of the base of the needle. Scripting name `needleSize` Data type float
Needle Stroke Color	The color of the needle's stroke. Scripting name `needleStrokeColor` Data type Color
Needle Stroke Size	The size of the needle's stroke.

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Scripting name `needleStrokeSize`
Data type float

Value Color — The color of the meter's current value label.

Scripting name `valueColor`
Data type Color

Tick Label Color — The color of the tick labels

Scripting name `tickLabelColor`
Data type Color

Tick Color — The color of tick marks.

Scripting name `tickColor`
Data type Color

Tick Size — The distance between ticks.

Scripting name `tickSize`
Data type double

Show Tick Labels? — If true, value will be shown on interval-boundry ticks.

Scripting name `ticks`
Data type boolean

Value Label Font — The font to use for the current value label.

Scripting name `valueFont`
Data type Font

Tick Label Font — The font to use for the tick labels.

Scripting name `labelFont`
Data type Font

Value Format — The number format to use for the value label.

Scripting name `valueLabelFormat`
Data type String

Tick Format — The number format to use for the tick labels.

Scripting name `tickLabelFormat`
Data type String

Arc Width — The width of the colored interval arcs

Scripting name `arcWidth`
Data type float

Meter Angle Extent — The extent, in degrees, of the entire meter.

Scripting name `meterAngleExtent`
Data type int

Meter Angle — The angle in degrees of the centerpoint of the meter (90 is straight up).

Scripting name `meterAngle`
Data type int

Dial Shape — The shape of the dial. This property determines how the dial face looks in the area not covered by the meter angle extent.

Scripting name `dialType`
Data type int
Values
- **1** Chord
- **0** Circle
- **2** Pie

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Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Value — The value to display in this meter. The needle and current value label will change to reflect this.

Scripting name	`value`
Data type	double
Flags	bindable

Overall Low Bound — The lower bound for the whole meter

Scripting name	`overallLow`
Data type	double
Flags	bindable

Overall High Bound — The high bound for the whole meter

Scripting name	`overallHigh`

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Data type double
Flags bindable

Reverse Range? If true, the meter will consider right to left needle movement as positive.

Scripting name `reverseRange`
Data type boolean

Data Quality The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Intervals

Interval 1 Low The lower bound of this interval.

Scripting name `interval1Low`
Data type double

Interval 1 High The upper bound of this interval.

Scripting name `interval1High`
Data type double

Interval 1 Outline The color to paint the arc of this interval.

Scripting name `interval1Outline`
Data type Color

Interval 1 Background The color to fill the wedge of this interval.

Scripting name `interval1Background`
Data type Color

Interval 2 Low The lower bound of this interval.

Scripting name `interval2Low`
Data type double

Interval 2 High The upper bound of this interval.

Scripting name `interval2High`
Data type double

Interval 2 Outline The color to paint the arc of this interval.

Scripting name `interval2Outline`
Data type Color

Interval 2 Background The color to fill the wedge of this interval.

Scripting name `interval2Background`
Data type Color

Interval 3 Low The lower bound of this interval.

Scripting name `interval3Low`
Data type double

Interval 3 High The upper bound of this interval.

Scripting name `interval3High`
Data type double

Interval 3 Outline The color to paint the arc of this interval.

Scripting name `interval3Outline`
Data type Color

Interval 3 Background The color to fill the wedge of this interval.

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Scripting name `interval3Background`
Data type Color

Interval 4 Low — The lower bound of this interval.
Scripting name `interval4Low`
Data type double

Interval 4 High — The upper bound of this interval.
Scripting name `interval4High`
Data type double

Interval 4 Outline — The color to paint the arc of this interval.
Scripting name `interval4Outline`
Data type Color

Interval 4 Background — The color to fill the wedge of this interval.
Scripting name `interval4Background`
Data type Color

Interval 5 Low — The lower bound of this interval.
Scripting name `interval5Low`
Data type double

Interval 5 High — The upper bound of this interval.
Scripting name `interval5High`
Data type double

Interval 5 Outline — The color to paint the arc of this interval.
Scripting name `interval5Outline`
Data type Color

Interval 5 Background — The color to fill the wedge of this interval.
Scripting name `interval5Background`
Data type Color

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

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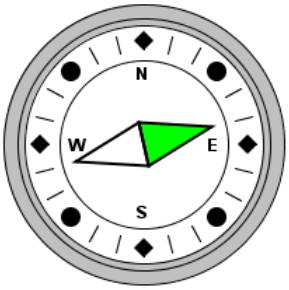
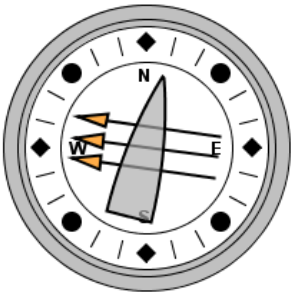
9.3.13 Compass



A basic compass.



Compasses can have up to 3 needles and have many needle types.

Description

The compass is a component that displays up to three needles at once on a cardinal direction compass. This can be useful for plotting anything that has a cardinal direction, such as the wind direction.

Each needle can be one of 9 different styles. Use the "Disabled" style to turn off any needle.

Properties

Appearance

Value 1 Color	The main color for Value 1's needle Scripting name `value1Color` Data type Color
Value 1 Outline	The outline color for value 1s needle Scripting name `value1OutlineColor` Data type Color
Value 2 Color	The main color for Value 2's needle Scripting name `value2Color` Data type Color
Value 2 Outline	The outline color for value 2s needle Scripting name `value2OutlineColor` Data type Color
Value 3 Color	The main color for Value 3's needle Scripting name `value3Color` Data type Color
Value 3 Outline	The outline color for value 3s needle Scripting name `value3OutlineColor` Data type Color
Label Font	The font to use for the compass's labels. Scripting name `labelFont` Data type Font
Rose Color	The background color of the rose. Scripting name `roseColor` Data type Color

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Rose Highlight

The highlight color of the rose.

Scripting name `roseHighlightColor`
Data type Color

Center Color

The center color of the compass

Scripting name `centerColor`
Data type Color

Styles

Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name

The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible

If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Value 1

Value 1 for the compass.

Scripting name `value1`
Data type double
Flags bindable

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Value 1 Needle

The needle type for this vaule.

Scripting name	`value1Needle`
Data type	int
Values	`-1` Disabled `0` Arrow `1` Line `2` Long `3` Pin `4` Plum `5` Pointer `6` Ship `7` Wind `9` Middle Pin

Value 2

Value 2 for the compass.

Scripting name	`value2`
Data type	double
Flags	bindable

Value 2 Needle

The needle type for this vaule.

Scripting name	`value2Needle`
Data type	int
Values	`-1` Disabled `0` Arrow `1` Line `2` Long `3` Pin `4` Plum `5` Pointer `6` Ship `7` Wind `9` Middle Pin

Value 3

Value 3 for the compass.

Scripting name	`value3`
Data type	double
Flags	bindable

Value 3 Needle

The needle type for this vaule.

Scripting name	`value3Needle`
Data type	int
Values	`-1` Disabled `0` Arrow `1` Line `2` Long `3` Pin `4` Plum `5` Pointer `6` Ship `7` Wind `9` Middle Pin

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

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Events

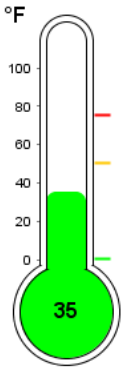
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.14 Thermometer



Description

This component displays a temperature value depicted as a level in a mercury thermometer. Three temperature intervals can optionally be defined with their own colors. The mercury will change color based on the range that it is in.

Properties

Appearance

Units

A string to describe the units for the current value label.

Scripting name	`units`
Data type	int
Values	0 None 1 Fahrenheit 2 Celcius 3 Kelvin

Thermometer Color

The color of the outline of the thermometer.

Scripting name	`thermometerColor`
Data type	Color

Axis Label Color

The color of the meter's y-axis label.

Scripting name	`axisColor`
Data type	Color

Mercury Color

The default color of the mercury.

Scripting name	`mercuryColor`
Data type	Color

Value Color

The color of the meter's current value label.

Scripting name	`valueColor`

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Data type Color

Value Label Font
The font to use for the current value label.
Scripting name valueFont
Data type Font

Thermometer Width
The width of the lines used to draw the thermomoter
Scripting name strokeWidth
Data type int
Flags expert

Use Range Color
Controls whether or not the mercury color changes based on the range it is in
Scripting name useSubrangePaint
Data type boolean
Flags expert

Styles
Contains the component's styles
Scripting name styles
Data type Dataset
Flags bindable | expert

Behavior

Follow data in ranges
If true, the thermometer's Y axis will scale itself to zoom in on the current range.
Scripting name followDataInSubranges
Data type boolean
Flags expert

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name border
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name toolTipText
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name cursorCode
Data type int
Values
0 Default
1 Crosshair
2 Text
3 Wait
12 Hand
13 Move

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4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Value

The value to display in this thermometer. The mercury level and value label will change to reflect this.

Scripting name	`value`
Data type	double
Flags	bindable

Overall Low Bound

The lower bound for the whole thermometer

Scripting name	`overallLow`
Data type	double
Flags	bindable

Overall High Bound

The high bound for the whole thermometer

Scripting name	`overallHigh`
Data type	double
Flags	bindable

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Intervals

Interval 1 Low

The lower bound of this interval.

Scripting name	`interval1Low`
Data type	double

Interval 1 High

The upper bound of this interval.

Scripting name	`interval1High`
Data type	double

Interval 1 Color

The color of this interval.

Scripting name	`interval1Color`
Data type	Color

Interval 2 Low

The lower bound of this interval.

Scripting name	`interval2Low`
Data type	double

Interval 2 High

The upper bound of this interval.

Scripting name	`interval2High`
Data type	double

Interval 2 Color

The color of this interval.

Scripting name	`interval2Color`
Data type	Color

Interval 3 Low

The lower bound of this interval.

Scripting name	`interval3Low`
Data type	double

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Interval 3 High — The upper bound of this interval.

Scripting name `interval3High`
Data type double

Interval 3 Color — The color of this interval.

Scripting name `interval3Color`
Data type Color

Scripting

Events

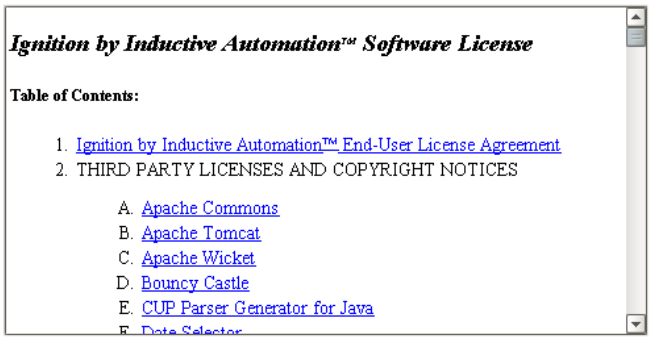
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.3.15 Document Viewer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Description

The document viewer is capable of loading and displaying a document that is available over the network at a URL. It is capable of displaying simple HTML and RTF documents. Although HTML links will be followed, it is *not* a fully functional interactive web browser. Its HTML support is rudimentary at best, and there is no JavaScript support. See the system.net.openURL function for a more robust solution for launching webpages, PDFs, etc.

This is component is useful for viewing machine manuals or operator protocol in HTML or RTF format. Note that in addition to HTML URLs (like "*http://www.google.com*"), you can load files as well using the URL format for files. Some examples:

```
file://localhost/C:/myfolder/file.txt
file://MyFileServer/resources/manuals/instructions.rtf"
```

Properties

Appearance

Font — Font of text of this component

Scripting name `font`
Data type Font

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Foreground Color
The foreground color of the component.
Scripting name foreground
Data type Color

Background Color
The background color of the component.
Scripting name background
Data type Color

Behavior

Link Action
What happens when the user clicks on a hpyerlink inside this document, if it is an HTML document.
Scripting name linkAction
Data type int
Values
0 Launch Externally
1 Launch Internally
2 Fire Event

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name componentEnabled
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name border
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name toolTipText
Data type String

Opaque
If false, backgrounds are not drawn. If true, backgrounds are drawn.
Scripting name opaque
Data type boolean

Data

Page URL
Set this to a URL to display that page. If the url startswith '/', it is assumed to be relative to the Gateway's HTTP address.
Scripting name page
Data type String
Flags bindable

Content Type
The content type of this document. Exampl: text/html
Scripting name contentType
Data type String

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text	The text of the document. Should match the content type Scripting name `text` Data type String

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- hyperlink
- focus
- propertyChange
- key

Scripting Functions

This component has no special scripting functions.

9.3.16 IP Camera Viewer

Description

The IP camera viewing component displays a video stream from a network camera directly in one of your windows. This can be a very powerful tool for allowing operators to view remote or inaccessible locations. Cameras can provide positive feedback about the state and position of machinery, weather, and other factors.

This component is capable of displaying two types of video:

MJPEG (a.k.a. Motion JPEG) is a streaming video protocol that compresses video frames using standard JPEG compression. Compression rates are quite good, requiring low network bandwidth utilization. Framerates depend greatly on the dimensions of the video, but typically range from 1-20 frames per second.

JPEG stills is not a true video protocol, but is rather the practice of continually refreshing an image that a camera is constantly overwriting. Its simplicity means that many cameras support it (usually along with another protocol). Frame rates are typically lower than MJPEG because a new connection must be opened for each frame.

Most network cameras on the market support one, if not both of these protocols. Even better, if you have an existing CCTV camera system, **video server** devices are available that CCTV camera inputs

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and provide MJPEG streams the network.

Finding the URL for your network camera's video stream is usually the only challenge in connecting this component. Most, if not all, network cameras have an internal web server, allowing viewers to use web browsers to view their video stream. If you go to that webpage, and look at the HTML source of the page, you should be able to find the URL of the MJPEG or JPEG still stream.

Some examples:
Axis 2100 (MJPEG): `http://ip.address.here/axis-cgi/mjpg/video.cgi?resolution=640x480`
Panasonic BL-C10A (MJPEG): `http://ip.address.here/nphMotionJpeg?Resolution=640x480&Quality=Standard`
StarDot Netcam (JPEG stills): `http://ip.address.here/netcam.jpg`

Properties

Appearance

Font — Font of text of this component
Scripting name: `font`
Data type: Font

Foreground Color — The foreground color of the component.
Scripting name: `foreground`
Data type: Color

Background Color — The background color of the component.
Scripting name: `background`
Data type: Color

Show Stats — If true, fps and Kbps statistical information will be overlaid on the video.
Scripting name: `showStats`
Data type: boolean

Behavior

Video Mode — Choose what type of video stream the URL points to.
Scripting name: `mode`
Data type: int
Values:
`0` MJPEG Stream
`1` JPEG Stills

Refresh Rate — The rate (in ms) to poll the image if mode is 'JPEG Stills'
Scripting name: `refreshRate`
Data type: int

Use Authentication? — If true, the URL connection will try to authenticate using the given username and password.
Scripting name: `useAuthentication`
Data type: boolean

Username — The username to authenticate with.
Scripting name: `username`
Data type: String

Password — The password to authenticate with.
Scripting name: `password`
Data type: String

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URL
The HTTP URL of the video stream to display

Scripting name `url`
Data type String

User-Agent
If non-empty, the HTTP User-Agent to spoof.

Scripting name `userAgent`
Data type String
Flags expert

Scale Video
Scale the video to the size of the viewer component. Warning: CPU-intensive.

Scripting name `scaleVideo`
Data type boolean
Flags expert

Scale Mode
The scaling performance hint to use.

Scripting name `scaleMode`
Data type int
Flags expert
Values
1 Default
2 Fast
4 Smooth
16 Area Averaging
8 Replicate

Connection Retries
The number of times to attempt to connect to the stream.

Scripting name `connectRetries`
Data type int

Retry Delay
The delay (in ms) to wait between connection attempts

Scripting name `retryDelay`
Data type int

Common

Name
The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
0 Default

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1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

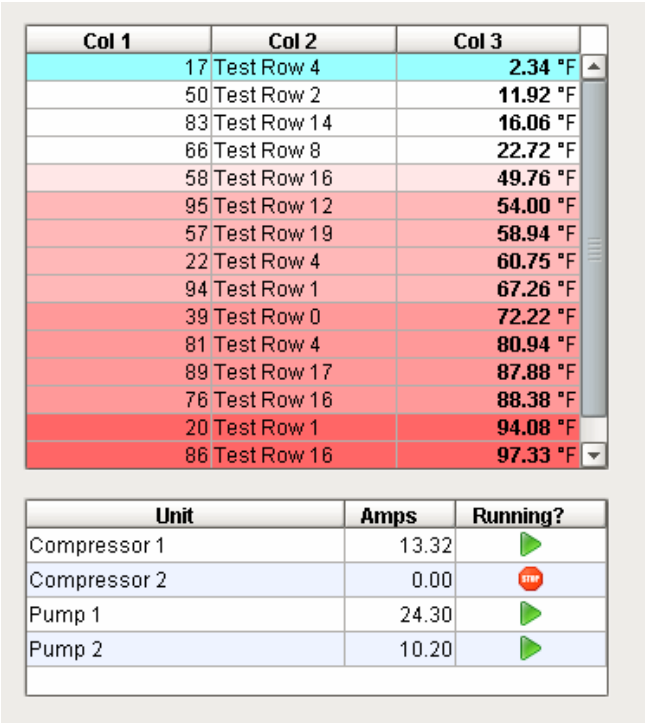
mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.4 Tables

9.4.1 Table


Col 1
Col 2
Col 3
17 Test Row 4 2.34 °F
50 Test Row 2 11.92 °F
83 Test Row 14 16.06 °F
66 Test Row 8 22.72 °F
58 Test Row 16 49.76 °F
95 Test Row 12 54.00 °F
57 Test Row 19 58.94 °F
22 Test Row 4 60.75 °F
94 Test Row 1 67.26 °F
39 Test Row 0 72.22 °F
81 Test Row 4 80.94 °F
89 Test Row 17 87.88 °F
76 Test Row 16 88.38 °F
20 Test Row 1 94.08 °F
86 Test Row 16 97.33 °F
Unit
Amps
Running?
Compressor 1 13.32
Compressor 2 0.00
Pump 1 24.30
Pump 2 10.20

Two tables showing a variety of display options

Description

The Table component is very powerful and easy to configure. It is very flexible, allowing you to easily

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display your tabular data in a variety of ways. Important features include:

Column Sorting. Your users can easily sort the data by clicking on the column headers. The sorting is a 3-mode sort: Ascending, Descending, and "Natural", which uses the default order of the data.

Mapped Row Coloring. Map the background color of each row to a particular column. This allows you to give powerful visual indication of different types of rows in you tables, such as differentiating between alarm states.

Column Translation. Allow the table component to handle all code mapping, such as mapping 0 to "Off" and 1 to "On". No fancy SQL knowledge required.

Images. Map values to images, allowing intuitive visual cues.

Progress Bar Indication. Display numeric data as progress bars inside cells, providing fast visual reference for bounded amounts.

Number and Date formatting. Format numbers and dates to your exact specification.

Column Hiding. Hide columns from view that contain identifying data used by the row coloring or by other components.

Printing. Print tables directly to multi-paged printouts.

Editing. Columns can be made editable. Changes will be reflected in the underlying dataset, at which point they can be mapped back to a database.

Basic Usage

The basic usage of the Table is to use a SQL Query binding on its *Data* property to let the table display data from a database. Often this query will by dynamic or indirect. See the Property Binding section for more information.

Binding to Selected Data

It is common to want to bind other components to values in the selected row of the table. In order to do this safely, you need to write an expression binding that protects against the case when nothing is selected or there are now rows. An expression like this would bind a label to the selected row's value for a column named "ProductCode":

```
if({Root Container.MyTable.selectedRow} = -1,
    "n/a", // this is the fail case
    {Root Container.MyTable.data}[{Root Container.MyTable.selectedRow}, "ProductCode"])
```

If you're binding to an integer, date, or other non-String type value thats inside a dateset, you'll need to *cast* the value to the correct type to make the expression parser happy. This binding would cast the selected "Quantity" column to an integer:

```
if({Root Container.MyTable.selectedRow} = -1,
    -1, // this is the fail case
    toInt({Root Container.MyTable.data}[{Root Container.MyTable.selectedRow}, "Quantity"]))
```

Changing the Column Widths

To change a table's column's widths, simply switch into preview mode and use your mouse to resize the columns, and then switch back to design mode. Simple!

Editable Table

By setting any column to *editable* in the Table's customizer, the user will be able to double-click in the cell and edit the data. You can the respond to the resulting `cellEdited` event with an event handler and persist the data. See the Event Types section for more information.

Exporting to HTML

You can export the table to an HTML file that retain's the table's formatting. To do this, use a script like this: (more about the table's exportHTML function is here.)

```
table = event.source.parent.getComponent("Table") # Get a reference to the table
table.exportHTML("MyTable.html", "My Table Header", 500) # Prompt user to save the exported fil
```

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Exporting to CSV

You can export the table's raw data to a CSV file. To do this, use a script like this: (more about the fpmi.db.exportCSV function is here.)

```
table = event.source.parent.getComponent("Table") # Get a reference to the table
system.dataset.exportCSV("mydata.csv", 1, table.data)
```

Printing

Printing a table is a snap! Simply use the table's built in `print` function like this:
table = event.source.parent.getComponent("Table") # Get a reference to the table
table.print()

See also:
SQL Query Binding
Expression Binding
Event Types - cellEdited
system.dataset.exportCSV
system.dataset.dataSetToExcel
system.dataset.dataSetToHTML
system.print.createPrintJob

Properties

Appearance

Font — Font of text of this component
Scripting name: `font`
Data type: Font

Foreground Color — The foreground color of the component.
Scripting name: `foreground`
Data type: Color

Background Color — The background color of the component.
Scripting name: `background`
Data type: Color

Header Font — Font of the table's header text
Scripting name: `headerFont`
Data type: Font

Header Foreground Color — The foreground color of the table's header.
Scripting name: `headerForeground`
Data type: Color

Header Visible — Whether or not the table header is visible.
Scripting name: `headerVisible`
Data type: boolean

Row Height — The height of each row, in pixels
Scripting name: `rowHeight`
Data type: int

Background Mode — This mode determines the color that this table's cell's backgrounds will be.
Scripting name: `backgroundColorMode`

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Data type int
Values
1 Constant
2 Alternating
3 Mapped

Odd Row Background
The color which odd rows will be colored if background mode is 'Alternating'
Scripting name oddBackground
Data type Color

Selection Background
The background color of a selected cell.
Scripting name selectionBackground
Data type Color
Flags expert

Selection Foreground
The foreground color of a selected cell.
Scripting name selectionForeground
Data type Color
Flags expert

Show Horizontal Grid Lines?
Scripting name showHorizontalLines
Data type boolean
Flags expert

Show Vertical Grid Lines?
Scripting name showVerticalLines
Data type boolean
Flags expert

Grid Line Color
The color used to draw grid lines.
Scripting name gridColor
Data type Color
Flags expert

Behavior

Selection Mode
This mode determines if only one row/cell/column can be selected at once, or single or multiple intervals
Scripting name selectionMode
Data type int
Values
0 Single
1 Single Interval
2 Multiple Interval

Row Selection Allowed
This flag is used in conjunction with the Column Selection Allowed flag to determine whether not whole-rows, whole-columns, or both (single-cells) are selectable.
Scripting name rowSelectionAllowed
Data type boolean

Column Selection Allowed
This flag is used in conjunction with the Row Selection Allowed flag to determine whether not whole-rows, whole-columns, or both (single-cells) are selectable.
Scripting name columnSelectionAllowed
Data type boolean

Resizing Allowed
Whether or not the user is allowed to resize table headers or not.
Scripting name resizingAllowed

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Data type boolean

Auto-Resize Mode — Determines how the table resizes the columns

Scripting name `autoResizeMode`
Data type int
Values
- 4 All Columns
- 3 Last Column
- 1 Next Column
- 0 Off
- 2 Subsequent Columns

Initially Selected Row — The index of the row that should be selected by default when this table's data is filled in.

Scripting name `initialRowSelection`
Data type int
Flags expert

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Enabled — If disabled, a component cannot be used.

Scripting name `componentEnabled`
Data type boolean

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name `opaque`
Data type boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
- 0 Default
- 1 Crosshair
- 2 Text
- 3 Wait
- 12 Hand
- 13 Move
- 4 SW Resize
- 5 SE Resize
- 6 NW Resize
- 7 NE Resize
- 8 N Resize

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9 S Resize
10 W Resize
11 E Resize

Data

Data — The data for this table

Scripting name	`data`
Data type	Dataset
Flags	bindable

Column Attributes Data — The dataset describing the column attributes.

Scripting name	`columnAttributesData`
Data type	Dataset
Flags	expert

Selected Column — The index of the first selected column, or -1 if none.

Scripting name	`selectedColumn`
Data type	int
Flags	bindable | expert

Selected Row — The index of the first selected row, or -1 if none.

Scripting name	`selectedRow`
Data type	int
Flags	bindable | expert

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Uncategorized

TestData — Toggle this property to fill in the table's data with random data.

Scripting name	`test`
Data type	boolean
Flags	expert

Properties Loading — The number of properties currently being loaded

Scripting name	`propertiesLoading`
Data type	int
Flags	bindable | read-only

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
cell
focus
propertyChange
key

Scripting Functions

`addRow(`newRow**`)`** — Adds a new row to the end of the table's dataset.

Parameters — PySequence `newRow` - A sequence containing the values for the new row. The length of the sequence must match the number of columns in the table, and each

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value must be coercible into the correct datatype of the corresponding column.

Returns nothing

deleteRow(rowIndex**)** Deletes a row from the table's dataset.

Parameters int `rowIndex` - The index of the row to delete.
Returns nothing

exportCSV(filename, shMissing description.

Parameters String `filename`
boolean `showHeaders`
Returns String

exportHTML(filename, tPrompts the user to save the table's data as an html file.

Parameters String `filename` - A suggested filename for the user. For example: "table_data.html"
String `title` - The title for the HTML page.
int `width` - The width (in pixels) for the "table" element in the resulting html page.
Returns String

getDataAsHTML(title, vCreates an HTML page as a string in memory. This can then be written to a file, a database, emailed, etc.

Parameters String `title` - The title for the HTML page.
int `width` - The width (in pixels) for the "table" element in the resulting html page.
Returns String - A string containing an HTML-formatted version of the table's data.

getRowsInViewOrdeReturns a list of ints that represent the underlying dataset's rows as they appear in the current sort order that the user is viewing.

Parameters none
Returns int[]

getSelectedColumnReturns the index of the currently selected column, or -1 if none is selected.

Parameters none
Returns int

getSelectedColumnReturns the number of columns that are currently selected.

Parameters none
Returns int

getSelectedColumnReturns a list of ints representing the currently selected columns.

Parameters none
Returns int[]

getSelectedRow() Returns the index of the currently selected row, or -1 if none is selected.

Parameters none
Returns int

getSelectedRowCouReturns the number of rows that are currently selected.

Parameters none
Returns int

getSelectedRows() Returns a list of ints that represent the currently selected rows.

Parameters none
Returns int[]

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isCellSelected(row Tests whether the cell at the given row and column is currently selected or not.

Parameters int row
int column
Returns boolean - 1 or 0 meaning selected or not selected, respectively.

isColumnSelected(Tests whether the given column is currently selected or not.

Parameters int column
Returns boolean

isRowSelected(row**)** Tests whether the given row is currently selected or not.

Parameters int row
Returns boolean

print(??, ??**)** This specialized print function will paginate the table onto multiple pages.

Parameters PyObject[] ??
String[] ??
Returns boolean

setColumnLabel(col Used to set a column's header label to a new string at runtime.

Parameters int column
String label
Returns nothing

setColumnSelectic Sets the given range of columns to be selected. If index0==index1, it will select a single column.

Parameters int index0
int index1
Returns boolean

setColumnWidth(col Used to set a column's width at runtime.

Parameters int column
int width
Returns nothing

setRowSelectionIr Sets the given range of rows to be selected. If index0==index1, it will select a single row.

Parameters int index0
int index1
Returns boolean

setSelectedColumn Sets the given column to be the selected column.

Parameters int ??
Returns nothing

setSelectedRow(??, Sets the given row to be the selected row.

Parameters int ??
Returns nothing

setValue(row, column, v Sets the value in the specified cell, altering the table's Data property. Will fire a propertyChange event for the "data" property, as well as a cellEdited event.

Parameters int row - The index of the row to set the value at.
int column - The index or name of the column to set a value at.

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PyObject `value` - The new value to use at the given row / column location.

Returns nothing

`sortByColumn(`columnInstructs the table to sort the data by the named column.

Parameters String `columnName`
boolean `asc` - 1 means ascending, 0 means descending. (default = 1) [optional]

Returns nothing

`sortOriginal()` Instructs the table to clear any custom sort columns and display the data as it is sorted in the underlying dataset.

Parameters none

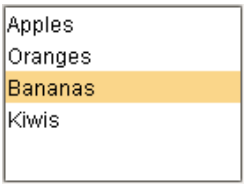
Returns nothing

`updateRow(`rowIndex, chUpdates an entire row of the table's dataset.

Parameters int `rowIndex` - The index of the row to update.
PyDictionary `changes` - A sequence containing the updated values for the row. The length of the sequence must match the number of columns in the table, and each value must be coercible into the correct datatype of the corresponding column.

Returns nothing

9.4.2 List



A basic List

Description

The List component displays a list of options, allowing freeform selection of the items. It is powered by a Dataset, from which it displays the first column.

Properties

Appearance

Font — Font of text of this component

Scripting name `font`
Data type Font

Foreground Color — The foreground color of the component.

Scripting name `foreground`
Data type Color

Background Color — The background color of the component.

Scripting name `background`
Data type Color

Layout Orientation — This property defines the orientation of the list elements.

Scripting name `layoutOrientation`
Data type int
Values `0` Vertical
`1` Vertical Wrap

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		2 Horizontal Wrap

Visible Row Count

An integer specifying the preferred number of rows to display without requiring scrolling.

Scripting name	`visibleRowCount`
Data type	int

Selected Foreground

The color of the foreground for the selected cell(s).

Scripting name	`selectedForeground`
Data type	Color

Selected Background

The color of the background for the selected cell(s).

Scripting name	`selectedBackground`
Data type	Color

Selected Focus Border

The border for the selected, focused cell.

Scripting name	`selectedFocusBorder`
Data type	Border

Styles

Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Selection Mode

This mode determines if only one cell can be selected at once, or single or multiple intervals

Scripting name	`selectionMode`	
Data type	int	
Values	0	Single
	1	Single Interval
	2	Multiple Interval

Common

Name

The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled

If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible

If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

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Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	`opaque`
Data type	boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Data — The data for the list. If multiple columns exist, the first will be used.

Scripting name	`data`
Data type	Dataset
Flags	bindable

Selected Index — The index of the selected cell, or -1 if none.

Scripting name	`selectedIndex`
Data type	int
Flags	bindable | expert

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
focus
propertyChange
key

Scripting Functions

`addSelectionInter` — Adds the options at indexes start through end (inclusive) to the selected options.

Parameters
- int `start` - The first index (stating at 0) to add to the selection.
- int `end` - The last index (stating at 0) to add to the selection.

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Returns nothing

clearSelection() Clears the current selection, making nothing selected.

Parameters none
Returns nothing

getSelectedIndice Returns a list of the selected indices in increasing order. Returns an empty list if nothing is selected.

Parameters none
Returns int[]

getSelectedValue (Returns the currently selected value, or None if the selection is empty

Parameters none
Returns Object

getSelectedValues Returns a list of the currently selected values. Returns an empty list if the selection is empty.

Parameters none
Returns Object[]

isSelectedIndex (ir Checks whether or not the given index is currently selected.

Parameters int `index`
Returns boolean

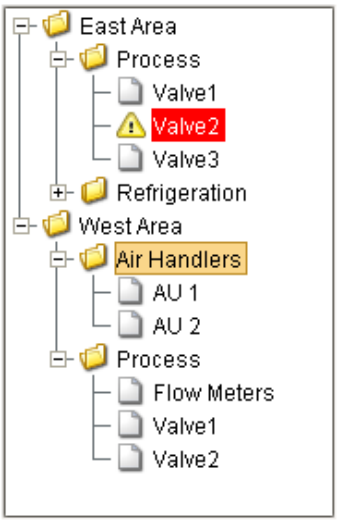
isSelectionEmpty (Checks to see if anything is selected in the list or not.

Parameters none
Returns boolean

setSelectedValue (Sets the currently selected value to the argument, if found in the list.

Parameters Object `value`
Returns nothing

9.4.3 Tree View



Trees are useful for navigating hierarchies.

Description

The Tree View component can display any tree hierarchy. It is configured by filling in a dataset. Each

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row in the dataset will become a node in the tree. Each node has a path, for example, "`West Area/Process/Valve1`" that determines its location in the tree. The *Separation Character* property (by default it is forward-slash), dictates how the paths are broken up. Any missing folder nodes needed by a leaf node are created implicitly.

The other columns in the dataset besides "Path" are used to configure the look for the node, both when it is selected and when it is not. Columns with the following names (case-insensitive) in the dataset will be recognized:

Path - the path determines the node's location. Broken up into a list by splitting on the separation character.
Text - the text of the node while not selected.
Icon - a path to an icon for the node. Use the value: "`default`" to use the tree automatic folder/leaf icons.
Background - a string column that will be coerced into a color for the unselected background. e.g. "`white`" or "`(255,255,255)`" Use an empty string to use the default color.
Foreground - a string representation of the unselected foreground color
Tooltip - if not empty, will be used as the tooltip for the node.
Border - a string that will be coerced into a Border for the node while unselected. May be empty.
SelectedText - the text of the node while selected.
SelectedIcon - a path to an icon for the node while selected. Use the value: "`default`" to use the tree automatic folder/leaf icons.
SelectedBackground - a string representation of the selected foreground color
SelectedForeground - a string representation of the selected foreground color
SelectedTooltip - if not empty, will be used as the tooltip for the node while selected.
SelectedBorder - a string that will be coerced into a Border for the node while selected. May be empty.

The Selected Item property will be updated as the user selects different nodes in the tree. It represents the index in the Items dataset at which the node is defined. If the selected node was implicitly created, the Selected Item will be -1. You can use this index to get the path and name of the selected node with an expression binding like this:

```
if ({Root Container.Tree View.selectedItem}<0,"n/a",
{Root Container.Tree View.data}[{Root Container.Tree View.selectedItem},"text"])
```

Properties

Appearance

Font	Font of text of this component
	Scripting name `font`
	Data type Font
Background Color	The background color of the component.
	Scripting name `background`
	Data type Color
Row Height	The height of each row in the tree
	Scripting name `rowHeight`
	Data type int
Show Root Handles	Whether or not to show handles next to parent nodes
	Scripting name `showRootHandles`
	Data type boolean

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Default Node Background — The default background of a node if no background is set

Scripting name	`defaultBackground`
Data type	Color
Flags	expert

Default Node Foreground — The default foreground of a node if no foreground is set

Scripting name	`defaultForeground`
Data type	Color
Flags	expert

Default Node Border — The default border of a node if no border is set

Scripting name	`defaultBorder`
Data type	Border
Flags	expert

Default Node Selected Background — The default selected background of a node if no background is set

Scripting name	`defaultSelectedBackground`
Data type	Color
Flags	expert

Default Node Selected Foreground — The default selected foreground of a node if no foreground is set

Scripting name	`defaultSelectedForeground`
Data type	Color
Flags	expert

Default Node Selected Border — The default selected border of a node if no border is set

Scripting name	`defaultSelectedBorder`
Data type	Border
Flags	expert

Default Leaf Icon — The default leaf icon if no icon is set

Scripting name	`defaultLeafIconPath`
Data type	String
Flags	expert

Default Open Icon — The default open icon if no icon is set

Scripting name	`defaultOpenIconPath`
Data type	String
Flags	expert

Default Closed Icon — The default closed icon if no icon is set

Scripting name	`defaultClosedIconPath`
Data type	String
Flags	expert

Line Style — The tree's line style

Scripting name	`lineStyle`
Data type	int
Flags	expert
Values	0 Angled
	2 None

Behavior

Separation Character — The separation character for the path

Scripting name	`separationCharacter`
Data type	String

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Auto Sort
Whether or not to automatically sort the tree
Scripting name `autoSort`
Data type boolean

Auto Expand
Whether or not to automatically expand all nodes in the tree
Scripting name `autoExpand`
Data type boolean

Selection Mode
What kind of selection regions does the tree allow.
Scripting name `selectionMode`
Data type int
Values
1 Single Selection
2 Multiple - Contiguous
4 Multiple - Discontiguous

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name `componentEnabled`
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Data

Items
Contains the items of the tree view
Scripting name `data`
Data type Dataset
Flags bindable

Selected Item
The index of the currently selected item, or -1 if no selection.
Scripting name `selectedItem`
Data type int
Flags bindable

Selected Path
The path of the currently selected item, or "" if no selection.
Scripting name `selectedPath`
Data type String
Flags bindable

Data Quality
The data quality code for any tag bindings on this component.
Scripting name `dataQuality`

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Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

`clearSelection()` Clears the current selection.

Parameters	none
Returns	nothing

`collapseAll()` Collapses all nodes in the tree.

Parameters	none
Returns	nothing

`expandAll()` Expands all nodes in the tree.

Parameters	none
Returns	nothing

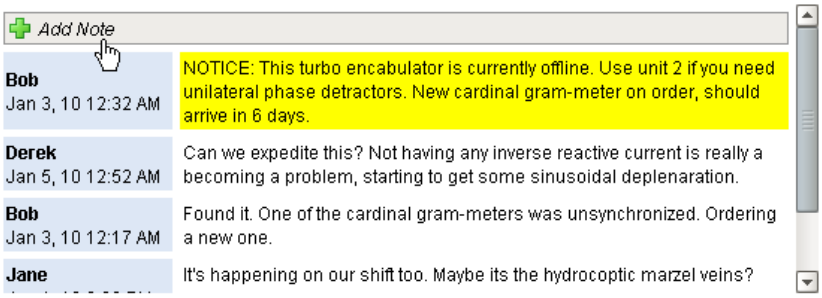
`getSelectedItems()` Returns a list of the selected item's indexes. These are the row indexes that the selected tree nodes were found in the underlying dataset. Implicitly created folder nodes that have no index will not be included.

Parameters	none
Returns	int[]

`getSelectedPaths()` Returns a list of the selected item's paths. A path to an item is the path to its parent plus its normal (non-selected) text.

Parameters	none
Returns	String[]

9.4.4 Comments Panel


Add Note
Bob
Jan 3, 10 12:32 AM
NOTICE: This turbo encabulator is currently offline. Use unit 2 if you need unilateral phase detractors. New cardinal gram-meter on order, should arrive in 6 days.
Derek
Jan 5, 10 12:52 AM
Can we expedite this? Not having any inverse reactive current is really a becoming a problem, starting to get some sinusoidal deplenaration.
Bob
Jan 3, 10 12:17 AM
Found it. One of the cardinal gram-meters was unsynchronized. Ordering a new one.
Jane
It's happening on our shift too. Maybe its the hydrocoptic marzel veins?

The database-powered Comments Panel helps operator collaboration.

Description

The comments panel is used to power a blog-style comments system within your project. This can be useful for ad-hoc collaboration and communication between shifts, remote users, etc. This component is driven by a dataset that should be bound to a SQL query. Unlike most components, this component has built-in functionality to alter an external database. This is how the Add Note

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functionality works. You have the opportunity to alter the queries that the components uses by changing their properties.

The schema that typically drives this component involves up to two tables. One table (by default: *Notes*) stores all of the notes across the board. The second table (by default, *ItemNotes*) is used to associate notes with other things. This allows you to have different sets of notes for different screens/ objects. Typically you'd bind the data to a query that joined these tables together restricting the second identifier in the ItemNotes table to the value appropriate for the window you're on. You'll also need to alter *Insert Query 2*'s "`YOURID`" placeholder so that new notes get put in the right spot. You can opt out of this two-table system by simply clearing out *Insert Query 2*.

Users can be given the choice to remove their own comments, and comments can have files attached. To allow attachments, make sure you have a BLOB field in your notes table.

This component expects that its dataset is populated with the following columns. The names do not need to be exact, but the data type in your notes table must match.

ID - an integer that should be the primary key for the notes table. Used for deleting and looking up attachments.
Username - the user who added the note. Must be a string/varchar.
Timestamp - when the note was added. Must be a Date or DateTime data type.
NoteText - The text of the note itself. Must be a string/varchar.
AttachmentFilename - filename for a file attached to the note. Must be a string/varchar.
Stick - 0 or 1 indicating whether or note the note is "sticky", which means it gets highlighted and put at the top. Must be a boolean or integer.

A short explanation for each of the queries and what is passed into them automatically. Note that the column names here do not need to match the ones in the Data property.

Insert Query 1: INSERT INTO Notes (Note, WhoID, TStamp, Attachment, Filename, Sticky) VALUES (?, (SELECT Id FROM Users WHERE Username='%s'), CURRENT_TIMESTAMP, ?, ?, ?)

This query will insert into your note table using the runPrepStmtGetKey() function and will be given four variables in the following order: note text, attachment blob, attachment filename, and sticky value. Also, it will pass in one string denoted by the %s. This is the name of the user that entered the note and does not need to be placed in any specific spot. *If you WhoID field is a string, you can replace (SELECT Id FROM Users WHERE Username='%s') with '%s' to pass the username in directly.*

Insert Query 2: INSERT INTO ItemNotes (AccountId, NoteId) VALUES (YOURID, %d)

This query is optional and will insert the note id from Insert Query 1 into a mapping table of your choice. You must replace YOURID with something meaningful for your mapping table. This is most commonly done by binding this query to an expression. The reason for this second query is to have a mapping table to be joined to the note table to filter out which notes belong to a particular Comment Panel component.

Delete Query: DELETE FROM Notes WHERE Id=%d

This query will use the note id from the component to delete the selected note.

Unstick Query: UPDATE Notes SET Sticky=0 WHERE Id=%d

This query will use the note id from the component to set the sticky value to 0.

Download Attachment Query: SELECT Attachment FROM Notes WHERE Id=%d

This query will use the note id from the component to download the attachment blob from the database.

Sample queries for the Data property binding:
Note that the data types in the database must be correct and the columns must be in this order

Assuming WhoID is a string that contains the username:

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```
SELECT ID, WhoID as 'Username', TStamp as 'Timestamp', Note as 'NoteText', Filename as 'Attachm
FROM notes
ORDER BY TStamp DESC
```

If WhoID is a foreign key linked to the Users Table:

```
SELECT n.ID, u.Username, n.TStamp, n.Note, n.Filename, n.Sticky
FROM notes n
INNER JOIN users u ON u.ID = n.WhoID
ORDER BY TStamp DESC
```

If WhoID is a string and your ItemNotes table links AccountId to NoteId

```
SELECT n.ID, n.WhoID, n.TStamp, n.Note, n.Filename, n.Sticky
FROM notes n
INNER JOIN ItemNotes i ON i.NoteId = n.ID
WHERE i.AccountID = 5
ORDER BY TStamp DESC
```

Properties

Appearance

Font — Font of text of this component

Scripting name: `font`
Data type: Font

Foreground Color — The foreground color of the component.

Scripting name: `foreground`
Data type: Color

Sticky Header Color — The background color of the header for sticky notes

Scripting name: `stickyHeaderColor`
Data type: Color

Sticky Note Color — The background color for stick notes

Scripting name: `stickyNoteColor`
Data type: Color

Header Color — The background color of the header notes

Scripting name: `headersColor`
Data type: Color

Note Color — The background color for notes

Scripting name: `noteColor`
Data type: Color

Date Format — The format string to use for the date of the note.

Scripting name: `dateFormat`
Data type: String

Add Note Text — The word(s) used for the "Add Note" button.

Scripting name: `addNoteText`
Data type: String

Cancel Text — The word(s) used for the "Cancel" button.

Scripting name: `cancelText`
Data type: String

Sticky Text — The word(s) used for the "Sticky" checkbox.

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Scripting name `stickyText`
Data type String

Attach File Text — The word(s) used for the "Attach File" link.

Scripting name `attachText`
Data type String

Padding — The amount of padding between the notes.

Scripting name `padding`
Data type int

Behavior

Database Connection — Name of the database connection to run the queries against. Leave blank to use project's default connection.

Scripting name `datasource`
Data type String

Insert Query 1 — This insert query will insert a new note into a notes table.
The placeholder %s will be replaced with the current username.
The query will be run as a prepared statement, so the query also needs to accept parameters by using the ? placeholder.
If attachments are enabled it will use four parameters: Note Body, Attachment Bytes, Attachment Name, Sticky (0/1)
When attachments are disabled, it will use two parameters: Note Body, Sticky (0/1)

Scripting name `insertQuery1`
Data type String

Insert Query 2 — This optional insert query inserts the mapping for a new note into a mapping table.
%d will be replaced with the ID of the new note.
To disable this behavior, simply set this property to a blank string.

Scripting name `insertQuery2`
Data type String

Delete Query — This query is used for deleting a note. %d is replaced with the note's ID

Scripting name `deleteQuery`
Data type String

Unstick Query — This query is used for changing a note's status to be not sticky. %d is replaced with the note's ID

Scripting name `unstickQuery`
Data type String

Download Attachment Query — This query is used for downloading binary attachments. %d is replaced with the note's ID

Scripting name `getAttachmentQuery`
Data type String

Delete Mode — Controls if anyone can delete any note, noone can delete a note, or only owners can delete their notes

Scripting name `deleteMode`
Data type int
Flags expert
Values
- 0 No Deletes
- 1 Owner Deletes
- 2 Any Deletes

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Attachments Enabled

Controls whether or not files can be attached to notes.

Scripting name	`attachmentsEnabled`
Data type	boolean

Download Mode

What to do when an attachment is downloaded.

Scripting name	`downloadMode`
Data type	int
Values	**0** Save
	1 Open

Skip Audit

If true, update queries originating from this component will skip the audit system. Can be important when attachments are turned on.

Scripting name	`skipAudit`
Data type	boolean
Flags	expert

Touchscreen Mode

Controls when this input component responds if touchscreen mode is enabled.

Scripting name	`touchscreenMode`
Data type	int
Flags	expert
Values	**0** None
	1 Single-Click
	2 Double-Click

Common

Name

The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible

If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Data

Data

Fill this DataSet in with the notes for the desired entity. Columns are: Id, Username, Timestamp, NoteBody, Filename, IsSticky

Scripting name	`data`
Data type	Dataset
Flags	bindable

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

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Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

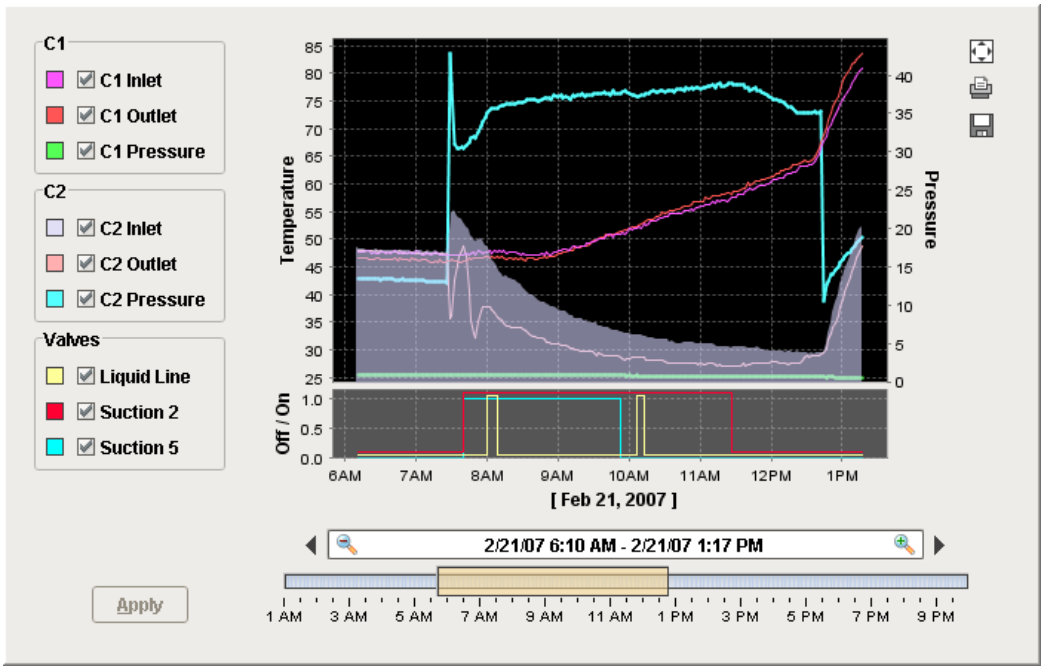
mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.5 Charts

9.5.1 Easy Chart



Description

This component is used to make powerful and runtime-configurable timeseries charts. It is configured by defining a set of *pens* and *axes*. Each pen represents a series of data. Pens can be many different styles, such as line, area, bar, and shape. This chart automatically creates controls for picking the time range and for hiding or displaying pens.

Features

Easy configuration
User-selectable set of pens
Automatic time-selection controls
SQL Query and/or SQLTags Historian data sources
Automatic SPC and calculated pen support
Zoom, Pan, X-Trace modes
Any number of Y-axes and subplots
Realtime or Historical

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Pens

The are three kinds of pens in the Easy Chart:

1. **SQLTags Historian Pens**. These pens pull their data from the SQLTags Historian system.
2. **Database Pens.** These pens will automatically create SQL SELECT queries to pull data from a database table. Typically, this is a table that is the target of a Historical Transaction Group.
3. **Calculated Pens**. These pens display a calculated dataset based off another pen, such as a moving average or an SPC function such as the UCL (Upper Control Limit).

Modes: Realtime vs Historical

The Easy Chart can operate in 3 different modes. These modes affect the range of data that is displayed, the controls the user is shown, and whether or not the chart polls for data.

1. **Historical Mode**. In this mode, the user is shown a Date Range component to pick the range of data to fetch and display. The initial values of this component are set through properties on the chart. In historical mode, the chart does not poll.
2. **Realtime Mode**. In this mode, the user is given the opportunity to pick the amount of time in the past to display. For example, the last 5 minutes or the last 2 hours. The chart will poll at a rate according to the *Poll Rate* parameter.
3. **Manual Mode**. In this mode, the chart will use the values if its *Start Date* and *End Date* parameters to govern what data is displayed. Polling is controlled by having the *Poll Rate* at zero (polling off) or greater than zero.

Basic Chart Configuration

The Easy Chart has many properties, like other components, that control its behavior. Things like its *Mode*, *Polling Rate*, etc are configured via the properties. All of the setup for adding pens, axes, subplots, etc is its Customizer. You can also drag and drop Historian-enabled SQLTags onto the chart directly in the Designer to add those tags as chart pens.

Y-Axes

The easy chart supports any number of Y-axes. To add an axis, go to the *Axes* tab of the chart customizer. When adding an axis, you get a number of options such as the type (numeric or logarithmic), label, color, autorange vs fixed range, and auto-ticks vs fixed ticks. You can also modify the position of the axis, but note that by default the Chart's *Auto Axis* Positioning property is enabled, which means that the chart will balance the axes automatically between left and right depending on demand. As pens are turned on and off by the user, only the axes that are used by visible pens are shown.

After you add your axes, you edit any pens that you want to use your new axes. Simply choose the new axis in the axis dropdown of the pen editing window.

Subplots

The Subplots feature lets you break up the chart's plot area into multiple distinct subplots that share the X axis, but have their own Y axes. This is often useful for digital data, as shown in the screenshot above. By default the chart has 1 subplot (the main plot). To add a new subplot, simply hit the add button in the *Subplots* tab of the chart customizer.

Subplots have relatively few options. The *Weight* option determines how much room the subplot gets relative to the other subplots. For example, in the screenshot above subplot #1's weight is 5, and subplot #2's weight is 1, leading to a 5-to-1 distribution of space. Just like axes, once you add your subplots you should go back to your pens and modify you pens' subplot property for any pens you want to appear on the subplot.

Pen Groups

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You can put your pens in groups to break up the pens into some logical separation. For instance, in the screenshot above there are three pen groups: C1, C2, and Valves. The group name is used as the titled border for the pens' grouping container. Groups also have another purpose, but it is more advanced and most people won't have to worry about it. For more, read the Dynamic Pens section below.

Advanced Configuration

Dynamic Pens

In is often the case that you'll want to make one chart window that services many similar pieces of equipment. For instance, if you have 30 tanks and they all have the same datapoints, you want to be able to use one window for all 30 of them and simply pass the tank number into the chart window as a parameter. There are actually a number of ways to accomplish this, each method suitable for different scenarios.

Database pens have 2 ways to be made dynamic. The first is the Chart's *Where Clause* property. This is a snippet of SQL where clause syntax, like "`machine_num = 28`" that will be included for *all* database pens in their queries. The second is to use a *dynamic group.* Any group can be made a dynamic group in the customizer. For each dynamic group, the easy chart will get a special dynamic property associated with that group. That property is another snippet of SQL where clause that will be applied to all database pens in that group.

The other way to make your pens (and anything else about the chart) dynamic at runtime is to use *dynamic configuration*. Read on...

Dynamic Configuration

The Easy Chart is not just meant to be easy to configure, but also very powerful. In particular, there is an emphasis on the ability to make any configuration change dynamically in a client - not just statically in the Designer. While a bit of scripting or clever property binding may be required, the technique is very powerful. This is achieved by storing all of the settings that you alter in the customizer in a set of expert-level dataset properties. So altering the datasets alters the chart configuration. You can inspect these various datasets, which hold the pens, axes, and subplot information, to see their format. They all look up information by column name (case-insensitive). So, if you have pen configuration stored in a database, you can bind an indirect SQL Query binding to alter the chart's pen set at runtime.

Properties

Appearance

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

Plot Background — The backgroud color for all plots, unless they override it

Scripting name	`plotBackground`
Data type	Color

Plot Outline — The color to use for the plot outline.

Scripting name	`plotOutlineColor`
Data type	Color

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Gridline Color
The color of the gridlines.
Scripting name gridlineColor
Data type Color

Gridline Width
The width (thickness) of the gridlines.
Scripting name gridlineWidth
Data type float

Gridline Dash Pattern
The dash pattern for the gridlines.
Scripting name gridlineDashPattern
Data type String

Border
The border surrounding the entire chart component.
Scripting name border
Data type Border

Chart Border
The border for the chart itself
Scripting name chartBorder
Data type Border

Pen Control Border
The border for the pen control panel, if visible
Scripting name penBorder
Data type Border

Date Range Border
The border for the date range control, if visible
Scripting name dateRangeBorder
Data type Border

Chart Title
Sets an optional title to be displayed above the chart
Scripting name title
Data type String

Title Font
The font for the optional chart title.
Scripting name titleFont
Data type Font

X Axis Label
The label shown on the X Axis (time axis)
Scripting name xAxisLabel
Data type String

X Axis Visible
Should the x-axis be displayed?
Scripting name xAxisVisible
Data type boolean
Flags expert

Font
Font of text of this component
Scripting name font
Data type Font

Axis Font
The font for axis labels
Scripting name axisLabelFont
Data type Font

Tick Font
The font for tick labels
Scripting name axisTickLabelFont
Data type Font

Behavior

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Chart Mode

Affects the mode that the chart operates in.Manual Mode: the data selected is determined by the values of the Start Date and End Date properties, which must be set manually.Historical Mode: a date range component will be displayed by the chart, allowing the user to select the time peried they are interested inRealtime Mode: the user will be given the change to choose a span of time, like 15 minutes, and that span will be updated at the poll rate as the data scrolls across

Scripting name	`chartMode`
Data type	int
Flags	bindable
Values	0 Manual 1 Historical 2 Realtime

Pen Control?

Controls whether or not end-users can turn on and off pens.

Scripting name	`allowPenManipulation`
Data type	boolean

Pen Control Mode

The style in which the pen control panel alters the chart configuration. In heavyweight mode, unchecked pens are not queried, but checking and unchecking pens refreshes the chart. In lightweight mode, all pens are queried, but checking and unchecking pens is quick.

Scripting name	`penControlMode`
Data type	int
Values	0 Heavyw eight 1 Lightw eight

Auto Apply

If true, user changes to pen visibility will occur immediately.

Scripting name	`autoApply`
Data type	boolean

Poll Rate

The rate (in milliseconds) at which this chart's queries poll. Historical charts don't use this property.

Scripting name	`pollRate`
Data type	int

X Axis AutoRange?

If true, the X axis will automatically fit the range of available data, if false, it will display a fixed range based on the start date and end date.

Scripting name	`xAxisAutoRange`
Data type	boolean

X Axis Margin

A margin for the upper and lower ends of the x axis, expressed as a percentage of the total range.

Scripting name	`xAxisMargin`
Data type	double

Empty Group Name

The group name to use for pens that are not in a pen group.

Scripting name	`emptyGroupName`
Data type	String

Group Pens

If true, pens will be grouped by their group name

Scripting name	`penGrouping`
Data type	boolean

Auto Axis Positioning

If true, axes alternate automatically between left and right, rather than being placed explicitly.

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Scripting name	`autoPositionAxes`
Data type	boolean
Flags	expert

Auto Pen Coloring — If true, pens are assigned different colors automatically.

Scripting name	`autoColorPens`
Data type	boolean
Flags	expert

Auto Color List — The list of colors to use if auto pen coloring is enabled

Scripting name	`autoColorList`
Data type	Color[]
Flags	expert

Show Loading — If true, an animated indicator will be shown when data is loading

Scripting name	`showLoading`
Data type	boolean

Show Warnings — If true, warnings generated during chart configuration will be printed to the console.

Scripting name	`showWarnings`
Data type	boolean
Flags	expert

Show Popup? — If true, a popup menu will be shown on right-click that allows the user to change mode, print, save, etc.

Scripting name	`showPopup`
Data type	boolean
Flags	expert

Show Tooltips? — If true, tooltips showing point values will be displayed on the chart.

Scripting name	`tooltips`
Data type	boolean

Chart Configuration

DB Pens — This Dataset defines all of the database pens for the chart.

Scripting name	`pens`
Data type	Dataset
Flags	bindable | expert

Tag Pens — This Dataset defines all of the SQLTag History pens for the chart.

Scripting name	`tagPens`
Data type	Dataset
Flags	bindable | expert

Calculated Pens — This Dataset defines the calculated pens for the chart.

Scripting name	`calcPens`
Data type	Dataset
Flags	bindable | expert

Axes — This Dataset defines all axis that can be used by the pens.

Scripting name	`axes`
Data type	Dataset
Flags	expert

Subplots — This Dataset defines all subplots' relative size and color.

Scripting name	`subplots`
Data type	Dataset
Flags	expert

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Common

Name

The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible

If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Flags	expert
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Selected X Value

The selected domain axis value for X-Trace and Mark modes.

Scripting name	`selectedXValue`
Data type	String
Flags	bindable | read-only

Tag History Resolution

The number of datapoints to request for tag history pens. -1 means automatic, which uses the width of the chart.

Scripting name	`tagHistoryResolution`
Data type	int
Flags	expert

Where Clause

A snippet of where clause that will be applied to all pens, like "TankNum = 2"

Scripting name	`globalWhereClause`
Data type	String

Start Date

For manual-mode. The start date to use for selecting pen data

Scripting name	`startDate`
Data type	Date
Flags	bindable

End Date

For manual-mode. The end date to use for selecting pen data

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Scripting name endDate
Data type Date
Flags bindable

Historical Range

Startup Range

For historical-mode date range. If startup mode is Automatic, this will be the starting range of time available for selection.

Scripting name startupRange
Data type String

Startup Selection

For historical-mode date range. If startup mode is Automatic, this will be the starting selected range.

Scripting name startupSelection
Data type String

Max Selection

For historical-mode date range. The maximum size of the selected date range

Scripting name maxSelectionSize
Data type String

Date Style

The style to display dates in. For international support.

Scripting name dateStyle
Data type int
Flags expert
Values
0 Auto
1 MDY
2 DMY
3 YMD

Time Style

The style to display times of day. For international support.

Scripting name timeStyle
Data type int
Flags expert
Values
15 Auto
16 12 HR
17 24 HR

Show Density

For historical-mode date range. If true, a data density histogram will be shown in the date range.

Scripting name showHistogram
Data type boolean

Today Color

For historical-mode date range. The color of the "Today Arrow" indicator

Scripting name todayIndicatorColor
Data type Color
Flags expert

Box Fill

For historical-mode date range. The fill color for the selection box.

Scripting name boxFill
Data type Color
Flags expert

Selection Highlight

For historical-mode date range. The focus highlight color for the selection box

Scripting name selectionHighlight
Data type Color
Flags expert

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Track Margin

For historical-mode date range. The amount of room on either side of the slider track. May need adjusting of default font is changed.

Scripting name	`trackMargin`
Data type	int
Flags	expert

Tick Density

For historical-mode date range. This is multiplied by the width to determine the current ideal tick unit.

Scripting name	`tickDensity`
Data type	float
Flags	expert

High Density Color

For historical-mode date range. The color used to indicate high data density.

Scripting name	`highDensityColor`
Data type	Color
Flags	expert

Layout

Plot Orientation

The plot orientation for all plots.

Scripting name	`plotOrientation`
Data type	int
Values	**1** Horizontal
	0 Vertical

Invert Time Axis

If true, the time axis values will increase from the right to left or from top to bottom depending on the Plot Orientation.

Scripting name	`invertTimeAxis`
Data type	boolean

Date Range

Affects the position of the date range control.

Scripting name	`dateRangeLocation`
Data type	int
Values	**1** Top
	2 Bottom

Legend

Where the legend should appear, if any.

Scripting name	`legend`
Data type	int
Values	**0** None
	1 Top
	2 Bottom
	3 Left
	4 Right

Horiz Gap

The horizontal spacing to use for the pen checkboxes

Scripting name	`hGap`
Data type	int
Flags	expert

Vert Gap

The vertical spacing to use for the pen checkboxes

Scripting name	`vGap`
Data type	int
Flags	expert

Alphabetize Pens

If true, pens visibility checkboxs will be alphabetized.

Scripting name	`alphabetizePens`

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Data type boolean
Flags expert

Pen Style Options

Bar Margin — The margin to use for the 'Bar' pen style

Scripting name `barMargin`
Data type double
Flags expert

Gap Threshold — The relative threshold to use for determining continuity breaks for the 'Discontinous Line' pen style

Scripting name `gapThreshold`
Data type double
Flags expert

3D X Offset — The offset to use in the x direction for the '3D Line' pen style

Scripting name `xOffset3D`
Data type int
Flags expert

3D Y Offset — The offset to use in the y direction for the '3D Line' pen style

Scripting name `yOffset3D`
Data type int
Flags expert

Digital Gap — The size of the gap to use between digital pens

Scripting name `digitalGap`
Data type double
Flags expert

Realtime Range

Unit Count — For realtime-mode date range. The number of units back to display

Scripting name `unitCount`
Data type int

Unit — For realtime-mode date range. The selected unit of the realtime date control

Scripting name `unit`
Data type int
Values
`1` Seconds
`60` Minutes
`360` Hours
`0`
`864` Days
`00`

Realtime Text — For realtime-mode date range. The text to display on the realtime date control.

Scripting name `rtLabel`
Data type String

Uncategorized

Properties Loading — The number of properties currently being loaded

Scripting name `propertiesLoading`
Data type int
Flags bindable | read-only

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Total Datapoints — The number of datapoints being displayed by the graph.

Scripting name	`datapoints`
Data type	int
Flags	bindable | read-only

Utility Buttons

Show Maximize Button? — If true, a small maximize button will be displayed next to the chart.

Scripting name	`showMaximize`
Data type	boolean

Show Print Button? — If true, a small print button will be displayed next to the chart.

Scripting name	`showPrint`
Data type	boolean

Show Save Button? — If true, a small save button will be displayed next to the chart.

Scripting name	`showSave`
Data type	boolean

Button Size — The size of the utility button icons.

Scripting name	`utilityButtonSize`
Data type	int
Flags	expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

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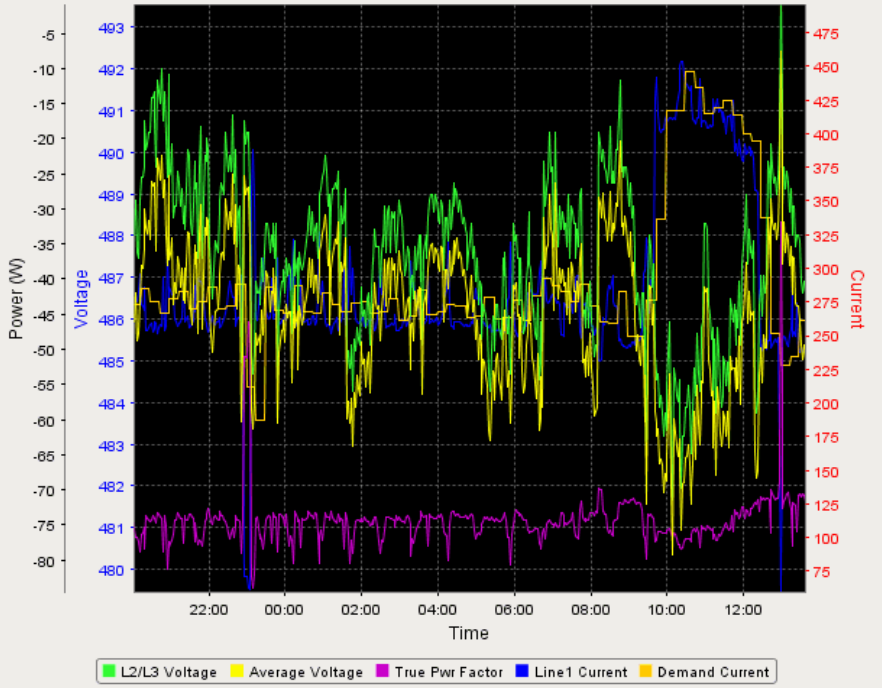
9.5.2 Chart



Description

The Chart component (also called the *Classic Chart* when contrasted with the Easy Chart) provides a flexible way to display either timeseries or X-Y charts that are powered by any number of datasets. Typically, these datasets are bound to SQL Query bindings.

Features

SQL Query and/or SQLTags Historian data sources
Zoom, Pan, X-Trace modes
Any number of Y-axes and subplots
Realtime or Historical
Many different rendering styles

Configuration

The basic idea behind configuring the class chart is simple: add datasets, and fill them in with data in a format that the chart understands. You add datasets to the chart using the chart's customizer. You then use standard property binding to put data into these charts. Commonly you'll use a SQL Query binding. Since these datasets are just normal dynamic properties, you can also access them via scripting.

The Customizer also lets you add additional X and Y axes. There are various types of axes, and they each have a large number of properties. Lastly, you can configure additional properties for each dataset, such as which axes it maps to, its visual style, subplot, etc.

Datasets

Each dataset should define one or more "series" (a.k.a "pens"). The format for these datasets is quite simple. Each series in a dataset shares common X-values, defined by the first column. Each additional column are the Y-values for a series. For example:

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t_stamp	motor_amps	motor_speed	motor_hoa_state
2010-01-13 8:05:00	16.8	223	0
2010-01-13 8:10:00	16.8	245	0
2010-01-13 8:15:00	16.9	244	1

Note that it is certainly not a coincidence that this looks just like a database table that the Historical Group is logging to. It is also what the result datasets of a SQLTags Historian query looks like.

Rows *must be* sorted in ascending order. The chart will draw and connect the points in whatever order you provide, them, so unless you want a jumbled mess - don't forget the **ORDER BY** clause in your query.
Make sure that your timestamp column, as well as other columns that may appear in your WHERE clause, are *indexed*. This will help your chart queries run much faster. We've seen queries that literally take over 5 minutes of database-cranking reduced to a few seconds with the addition of an index.
String values are not allowed (except in category chart x-values, see below). Make sure your database columns are numeric, or date/time for x-values.

Binding Techniques
The classic chart can be used to make almost any kind of chart, with some effort. Historical, realtime, dynamic pen selection, etc is all possible. Your job is just to fill the datasets with the pertinent data, and the chart will display it.

The most common idea is to make the chart dynamic by varying the date range that the datas'ts SQL Query bindings run. This is easy to do by adding a Date Range component and using Indirect Bindings.

Chart Type: XY vs Category
The classic chart is typically in `XY Plot` mode. This means that the x-axis is either date or numeric, and the y-axes are numeric. If your x-axis is categorical (names, not numbers), you can switch the *Chart Type* property to `Category Chart`. Don't be surprised when you get a few errors - you'll need to go and switch your x-axis to be a Category Axis, and fill your dataset in with valid category data, that is, String-based x-values. This is most often used with the bar-renderer (see the Customizer).

Properties

Appearance

Font
Font of text of this component
Scripting name `font`
Data type Font

Foreground Color
The foreground color of the component.
Scripting name `foreground`
Data type Color

Background Color
The background color of the component.
Scripting name `background`
Data type Color

Plot Background
The backgroud color for all plots, unless they override it
Scripting name `plotBackground`
Data type Color

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Chart Title
An optional title that will appear at the top of the chart.
Scripting name `title`
Data type String

Chart Orientation
The orientation of the domain axis of the chart.
Scripting name `orientation`
Data type int
Values
0 Horizontal
1 Vertical

Show Legend?
If true, a legend will be shown for the series displayed in the chart.
Scripting name `legend`
Data type boolean

Selection Highlight Color
The color of the selection highlight
Scripting name `selectionHighlightColor`
Data type Color
Flags expert

Selection Highlight Width
The line width of the selection highlight
Scripting name `selectionHighlightWidth`
Data type float
Flags expert

Behavior

Chart Type
Choose the type for this chart: XY (Numeric X-axis) or Category (String X-axis)
Scripting name `chartType`
Data type int
Values
2 XY Plot
0 Category Chart

Extract Order
Extract order for how category datasets should be interpreted.
Scripting name `extractOrder`
Data type int
Values
0 By Col
1 By Row

Subplot Mode
The axis that subplots share if more than 1 subplot.
Scripting name `subplotMode`
Data type int
Values
0 Shared Domain
1 Shared Range

Show Tooltips?
If true, tooltips showing point values will be displayed.
Scripting name `tooltips`
Data type boolean

Show Popup?
If true, a popup menu will be shown on right-click that allows the user to change mode, print, save, etc.
Scripting name `showPopup`
Data type boolean
Flags expert

Selection Enabled?
If true, the user will be able to select datapoints on the chart. The selected datapoint will be highlighted, and the "selectedData" property will reflect it.

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Scripting name selectionEnabled
Data type boolean

Common

Name — The name of this component.

Scripting name name
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name visible
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name border
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name toolTipText
Data type String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name cursorCode
Data type int
Flags expert
Values
- 0 Default
- 1 Crosshair
- 2 Text
- 3 Wait
- 12 Hand
- 13 Move
- 4 SW Resize
- 5 SE Resize
- 6 NW Resize
- 7 NE Resize
- 8 N Resize
- 9 S Resize
- 10 W Resize
- 11 E Resize

Data

Selected Datapoint — The currently selected datapoint

Scripting name selectedData
Data type String
Flags bindable | read-only

Selected X Value — The selected domain axis value for X-Trace and Mark modes.

Scripting name selectedXValue
Data type String
Flags bindable | read-only

Data Quality — The data quality code for any tag bindings on this component.

Scripting name dataQuality
Data type int
Flags bindable | expert

Uncategorized

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Properties Loading — The number of properties currently being loaded

Scripting name	`propertiesLoading`
Data type	int
Flags	bindable | read-only

Scripting

Events

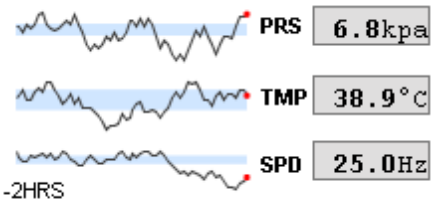
The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

9.5.3 Sparkline Chart



Three sparklines used to augment a numeric readout

Description

The sparkline chart is a minimalistic chart component that displays a line-chart history for a single datapoint. Sparklines were invented by Edward Tufte as a way to show a great deal of contextual information in a very small amount of space. Sparklines are typically used to display the recent history (up to current time) of a datapoint so that the viewer can quickly discern the recent trend of a datapoint: is it rising? falling? oscillating? etc..

To use a sparkline, bind its *Data* property either to a SQLTag Historian realtime query, or to a database query. There should be two columns in this dataset: the first one a date column, the second a number. Each row will become a datapoint on the chart, and the dataset must be sorted by time in ascending order.

Instead of using axes to convey scale, the sparkline can display a band of color across the back of the chart which indicates the desired operating range of the datapoint. In this way, it is instantly obvious when a value is in its expected range, above that range, or below. The sparkline automatically configures its internal axes based on the data given to it. To give it a fixed range, simply fill in the *Range High* and *Range Low* properties.

Properties

Appearance

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

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Line Color
The color of the sparkline.
Scripting name `foreground`
Data type Color

Line Width
The width of the sparkline.
Scripting name `lineWidth`
Data type float

Desired Range Color
The color of the desired operating range band. Only used if the desired operating range is configured.
Scripting name `desiredRangeColor`
Data type Color

Border Inset
The amount of space to inset the chart inside its border.
Scripting name `borderInset`
Data type double

Styles
Contains the component's styles
Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name `cursorCode`
Data type int
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize
`8` N Resize
`9` S Resize
`10` W Resize

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11 E Resize

Data

Data
The history data to draw in the sparkline chart.

Scripting name	`data`
Data type	Dataset
Flags	bindable

Range High
A fixed value for the upper edge of the chart. If left blank (null), the upper range will be calculated automatically.

Scripting name	`rangeHi`
Data type	Double

Range Low
A fixed value for the lower edge of the chart. If left blank (null), the lower range will be calculated automatically.

Scripting name	`rangeLo`
Data type	Double

Desired High
The high value of the desired operating range. If left blank (null), no desired range band will be shown.

Scripting name	`desiredHi`
Data type	Double

Desired Low
The low value of the desired operating range. If left blank (null), no desired range band will be shown.

Scripting name	`desiredLo`
Data type	Double

First Value
The first (oldest) value in the dataset

Scripting name	`firstValue`
Data type	Double
Flags	bindable | read-only

Last Value
The last (most recent) value in the dataset.

Scripting name	`lastValue`
Data type	Double
Flags	bindable | read-only

Min Value
The smallest value in the dataset.

Scripting name	`minValue`
Data type	Double
Flags	bindable | read-only

Max Value
The largest value in the dataset.

Scripting name	`maxValue`
Data type	Double
Flags	bindable | read-only

Chart Max
The value that corresponds to the upper edge of the chart.

Scripting name	`chartMax`
Data type	Double
Flags	bindable | read-only

Chart Min
The value that corresponds to the lower edge of the chart.

Scripting name	`chartMin`
Data type	Double
Flags	bindable | read-only

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Data Quality — The data quality code for any tag bindings on this component.

Scripting name: `dataQuality`
Data type: int
Flags: bindable | expert

Markers

First Marker Color — The color of the first value marker

Scripting name: `firstMarkerColor`
Data type: Color

First Marker Style — The style of the first value marker

Scripting name: `firstMarkerStyle`
Data type: int
Values:

`-1`	None
`0`	Circle
`1`	Empty Circle
`2`	Triangle1
`3`	Empty Triangle1
`4`	Triangle2
`5`	Empty Triangle2
`6`	Square
`7`	Empty Square

First Marker Size — The size of the first value marker

Scripting name: `firstMarkerSize`
Data type: double

Last Marker Color — The color of the last value marker

Scripting name: `lastMarkerColor`
Data type: Color

Last Marker Style — The style of the last value marker

Scripting name: `lastMarkerStyle`
Data type: int
Values:

`-1`	None
`0`	Circle
`1`	Empty Circle
`2`	Triangle1
`3`	Empty Triangle1
`4`	Triangle2
`5`	Empty Triangle2
`6`	Square
`7`	Empty Square

Last Marker Size — The size of the last value marker

Scripting name: `lastMarkerSize`
Data type: double

Low Marker Color — The color of the low value marker

Scripting name: `loMarkerColor`
Data type: Color

Low Marker Style — The style of the low value marker

Scripting name: `loMarkerStyle`
Data type: int
Values:

`-1`	None
`0`	Circle
`1`	Empty Circle

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		2 Triangle1
		3 Empty Triangle1
		4 Triangle2
		5 Empty Triangle2
		6 Square
		7 Empty Square
Low Marker Size	The size of the low value marker	
	Scripting name	loMarkerSize
	Data type	double
High Marker Color	The color of the high value marker	
	Scripting name	hiMarkerColor
	Data type	Color
High Marker Style	The style of the high value marker	
	Scripting name	hiMarkerStyle
	Data type	int
	Values	-1 None
		0 Circle
		1 Empty Circle
		2 Triangle1
		3 Empty Triangle1
		4 Triangle2
		5 Empty Triangle2
		6 Square
		7 Empty Square
High Marker Size	The size of the high value marker	
	Scripting name	hiMarkerSize
	Data type	double

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

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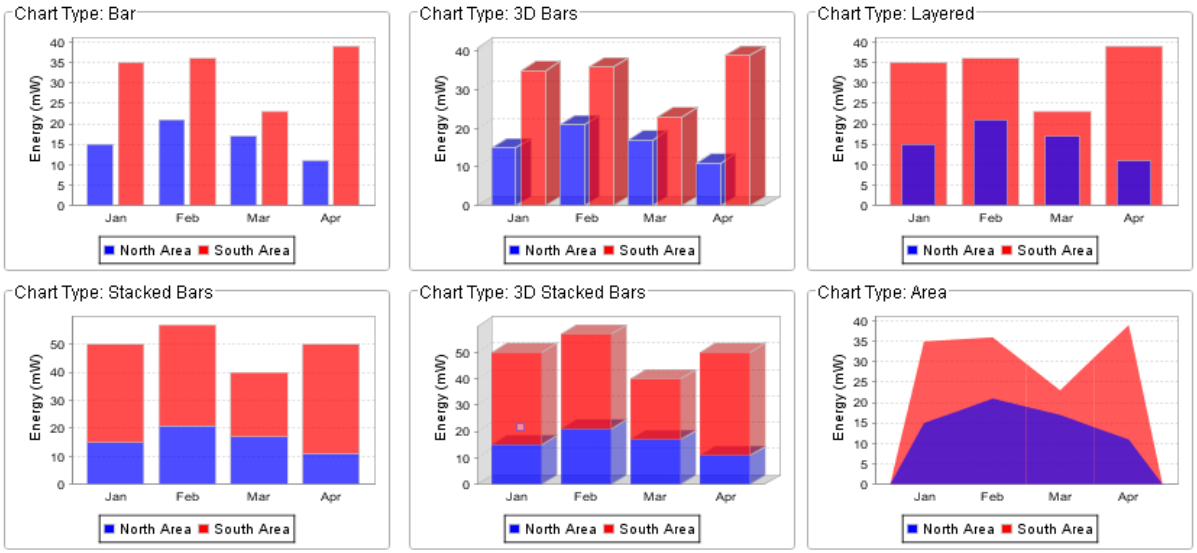
9.5.4 Bar Chart



Description

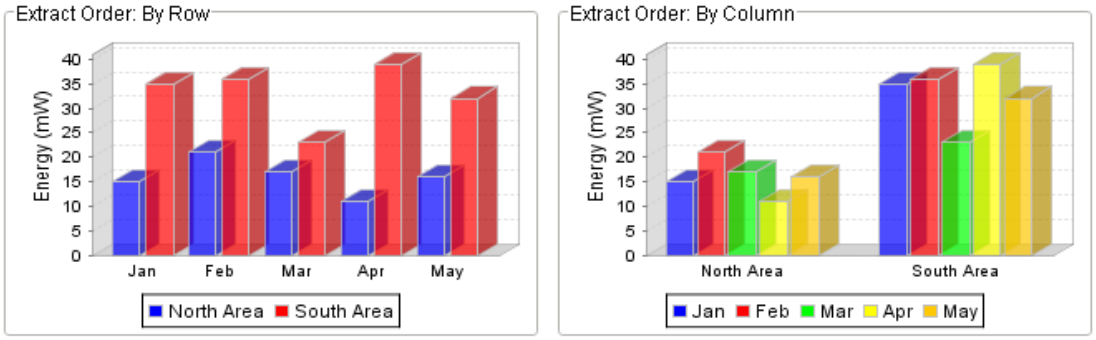
The Bar Chart is a very easy-to-use chart that provides familiar bar charts. It also can be configured to display other kinds of category charts. A category chart is a chart whose X-values are categories (strings) rather than numeric values (numbers, dates).

Like most chart components (other than the Easy Chart), the *Data* property drives the chart. The first column in the Data dataset defines the names of the categories. The rest of the columns define the values for each of the series (if there is more than one series per category), and thus should be numeric. Note - if your data is 'turned on its side', meaning that the columns define the categories and rows define the series, then set the Extract Order to "By Column".

Extract Order Example

The following two charts demonstrate the effects of the extract order property on the given dataset

Label (String)	**North Area** (Integer)	**South Area** (integer)
Jan	15	35
Feb	21	36
Mar	17	23
Apr	11	39
May	16	32



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Properties

Appearance

Chart Title
An optional title that will appear at the top of the chart.

Scripting name	`title`
Data type	String

Chart Type
Controls how the bar chart is displayed.

Scripting name	`rendererType`
Data type	int
Values	**0** Bar **1** 3D Bars **2** Stacked Bars **3** 3D Stacked Bars **4** Layered **5** Area

Plot Background
The backgroud color for the plot.

Scripting name	`plotBackground`
Data type	Color

Series Colors
The sequence of colors used for series in the bar chart.

Scripting name	`seriesColors`
Data type	Color[]

Legend?

Scripting name	`legend`
Data type	boolean

Labels?
Always display labels?

Scripting name	`labels`
Data type	boolean

Gradient bars?
If true, bars will be painted with a gradient 'shine'.

Scripting name	`gradient`
Data type	boolean

Shadows?
If true, bars will have a drop-shadow beneath them.

Scripting name	`shadows`
Data type	boolean

Foreground Transparency
The transparency of the pie (useful for 3D pies)

Scripting name	`foregroundAlpha`
Data type	float

Vertical
Sets the orientation of the chart to vertical (true) or horizontal(false)

Scripting name	`vertical`
Data type	boolean

Category Margin
The marign between categories as a fraction of the total space

Scripting name	`categoryMargin`
Data type	double

Item Margin
The margin between bars in a category as a fraction

Scripting name	`itemMargin`
Data type	double

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Axes

Value Axis Label
The label for the value axis

Scripting name `valueLabel`
Data type String

Category Axis Label
The label for the category axis

Scripting name `categoryLabel`
Data type String

Value Axis Auto-Range
If true, the value axis range will be determined automatically. If false, the specified upper and lower bounds will be used.

Scripting name `valAxisAutoRange`
Data type boolean

Value Axis Lower Bound
The lower bound of the value axis. Used only when auto-range is false.

Scripting name `valAxisLowerBound`
Data type double

Value Axis Upper Bound
The upper bound of the value axis. Used only when auto-range is false.

Scripting name `valAxisUpperBound`
Data type double

Category Axis Label Angle
The angle for the value axis' labels.

Scripting name `catAxisLabelPosition`
Data type int
Values
- 0 Standard
- 1 Down 45
- 2 Down 90
- 3 Up 45
- 4 Up 90

Title Font
The font for the chart's title.

Scripting name `titleFont`
Data type Font

Legend Font
The font for the legend items.

Scripting name `legendFont`
Data type Font

Bar Label Font
The font for the bar labels.

Scripting name `barLabelFont`
Data type Font

Bar Label Offset
The offset between the bar and the bar label.

Scripting name `barLabelOffset`
Data type double
Flags expert

Value Axis Label Font
The font for the value axis label.

Scripting name `valAxisLabelFont`
Data type Font

Category Axis Label Font
The font for the category axis label.

Scripting name `catAxisLabelFont`
Data type Font

Value Axis Tick Font
The font for the value axis' ticks.

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Scripting name `valAxisTickFont`
Data type Font

Category Axis Tick Font — The font for the category axis' ticks.

Scripting name `catAxisTickFont`
Data type Font

Bar Label Color — The color for the bar labels.

Scripting name `barLabelColor`
Data type Color

Value Axis Label Color — The color for the value axis label.

Scripting name `valAxisLabelColor`
Data type Color

Category Axis Label Color — The color for the category axis label.

Scripting name `catAxisLabelColor`
Data type Color

Value Axis Tick Color — The color for the value axis' ticks.

Scripting name `valAxisTickColor`
Data type Color

Category Axis Tick Color — The color for the category axis' ticks.

Scripting name `catAxisTickColor`
Data type Color

Value Axis Upper Margin — The upper margin, as a percentage, of the value axis. Only used when auto-range is true.

Scripting name `valAxisUpperMargin`
Data type double

Category Axis Upper Margin — The upper margin, as a percentage, of the category axis.

Scripting name `catAxisUpperMargin`
Data type double

Category Axis Lower Margin — The lower margin, as a percentage, of the category axis.

Scripting name `catAxisLowerMargin`
Data type double

Behavior

Tooltips?

Scripting name `tooltips`
Data type boolean

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`

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Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Flags expert
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize
`8` N Resize
`9` S Resize
`10` W Resize
`11` E Resize

Data

Data — The data driving the chart.

Scripting name `data`
Data type Dataset

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Extract Order — Controls whether the first row defines the categories or the series

Scripting name `extractOrder`
Data type int
Values
`0` By Column
`1` By Row

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

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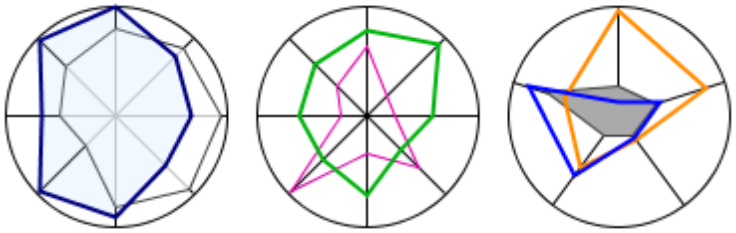
9.5.5 Radar Chart



Description

Radar charts, also known as web charts, spider charts, spider plots, and a few other names, display multivariate data sets as two dimensional polygons. Each dataset, or series, contains values for three or more variables. The plot is then arranged as a set of spokes with equal angles between them. Each spoke represents a value axis for the variable it corresponds to. Each series is then drawn as a connected polygon, where the points of the polygon are arranged on the spokes according to their value.

The intended use of radar plots is to display realtime information in such a way that outliers can be quickly identified. By displaying two series on top of each other, it quickly becomes apparent if one series deviates from the other, and upon which spokes. This can be an efficient way to convey if a process is running on-spec or off-spec at a glance.

The radar chart gets its data from a dataset. Each row in the dataset will become a single series (polygon) on the chart. The dataset's first column represents the name of the series, and subsequent columns represent the values. To display realtime data on a radar chart, you can use a cell-update binding to bind individual values to tag values. Alternatively, you can have realtime information stored by a transaction group to a database table, and drive the radar chart's dataset with a query binding.

Properties

Appearance

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

Series Config — Contains the visual configuration for each series

Scripting name	`seriesConfig`
Data type	Dataset

Border Inset — The amount of area that the chart should be inset from the component bounds.

Scripting name	`borderInset`
Data type	double
Flags	expert

Spoke Width — The line width for the chart's spokes and exterior ring.

Scripting name	`strokeWidth`
Data type	float

Spoke Color — The color to use for the chart's spokes and exterior ring.

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Scripting name `foreground`
Data type Color

Styles — Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Series Data — Contains the datapoints for each series. Each row will become a polygon on the chart

Scripting name `seriesData`
Data type Dataset
Flags bindable

Spoke Min — The value that corresponds to the centerpoint of the chart. The low value for each spoke.

Scripting name `spokeMin`
Data type double

Spoke Max — The value that corresponds to the outer edge of the chart. The high value for each spoke

Scripting name `spokeMax`
Data type double

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Data Quality	The data quality code for any tag bindings on this component.
Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

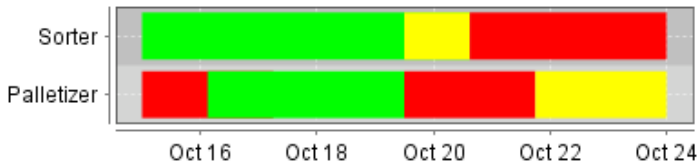
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.5.6 Status Chart



Description

The status chart component allows you to visualize the status of one or more discrete datapoints over a time range. The X-axis is always a timeseries axis, and the Y-axis is a category axis, with one entry per data series. The chart is populated with a single dataset, the first column of which must be a datetime column.

Wide vs Tall Datasets.

In `Wide` format, all of the columns but the first must be numeric. These "series" columns' headers will be used as the names on the y-axis. In Tall format, there should be exactly 3 columns. The first is the timestamp, the second is the series name, and the third is the value. For example:

Wide Format			Tall Format		
t_stamp	Valve1	Valve	t_stamp	Name	Value
2010-01-13 8:00:00	0	2	2010-01-13 8:00:00	Valve1	0
2010-01-13 8:02:00	0	2	2010-01-13 8:00:00	Valve2	2
2010-01-13 8:04:00	1	2	2010-01-13 8:02:00	Valve1	0
2010-01-13 8:06:00	1	1	2010-01-13 8:02:00	Valve2	2
2010-01-13 8:08:00	0	1	2010-01-13 8:04:00	Valve1	1
			2010-01-13 8:04:00	Valve2	2
			2010-01-13 8:06:00	Valve1	1
			2010-01-13 8:06:00	Valve2	1
			2010-01-13 8:08:00	Valve1	0
			2010-01-13 8:08:00	Valve2	1

Color Mapping

Apart from getting the data into the series chart, the only other commonly configured option is the mapping of discrete values to colors. This is done in the Series Chart Customizer. Each named series can have its own mapping of colors, if desired. These mappings are stored in the expert-level

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dataset property *Series Properties Data* so they can be altered at runtime.

Properties

Appearance

Background Color
The background color of the component.

Scripting name	`background`
Data type	Color

Chart Title
Title of this chart.

Scripting name	`chartTitle`
Data type	String

Title Font
Font of the chart title.

Scripting name	`titleFont`
Data type	Font

Title Color
Color of the chart title.

Scripting name	`titleColor`
Data type	Color

Series Spacing
Affects the amount of spacing between series. Can be between 0.0 and 1.0. The series present on this chart are given equal space to display themselves. Series spacing is the precentage of that space that they use to do so.

Scripting name	`seriesSpacing`
Data type	double

Date Style
The style to display dates in. For international support.

Scripting name	`dateStyle`
Data type	int
Flags	expert
Values	**0** Auto **1** MDY **2** DMY **3** YMD

Time Style
The style to display times of day. For international support.

Scripting name	`timeStyle`
Data type	int
Flags	expert
Values	**15** Auto **16** 12 HR **17** 24 HR

Common

Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

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Scripting name `border`
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name `cursorCode`
Data type int
Flags expert
Values
`0` Default
`1` Crosshair
`2` Text
`3` Wait
`12` Hand
`13` Move
`4` SW Resize
`5` SE Resize
`6` NW Resize
`7` NE Resize
`8` N Resize
`9` S Resize
`10` W Resize
`11` E Resize

Data

Data Format
Format of the incoming data. In "wide" format, the first column of the dataset needs to be a timestamp, and every subsequent column represents one series in the chart. In "tall" format, the first column is a timestamp, the second column is a series name, and the third a value.
Scripting name `dataFormat`
Data type int
Values
`0` Wide
`1` Tall

Series Data
Data about each series. Data can be in either "wide" or "tall" format.
Scripting name `data`
Data type Dataset
Flags bindable

Series Properties Data
Properties for each series
Scripting name `properties`
Data type Dataset
Flags bindable | expert

Data Quality
The data quality code for any tag bindings on this component.
Scripting name `dataQuality`
Data type int
Flags bindable | expert

Domain Axis

Domain Axis Label
Label on the domain axis.
Scripting name `domainAxisLabel`
Data type String

Domain Axis Font
Font used on the domain axis.

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Scripting name domainAxisFont
Data type Font

Domain Axis Color — Color used on the domain axis.

Scripting name domainAxisColor
Data type Color

Domain Axis Location — Location of the domain axis.

Scripting name domainAxisLocation
Data type int
Values 2 Left
3 Right

Show Domain Axis — Sets whether or not the domain axis is visible

Scripting name domainAxisVisible
Data type boolean

Range Axis

Range Axis Label — Label on the range axis.

Scripting name rangeAxisLabel
Data type String

Range Axis Font — Font used on the range axis.

Scripting name rangeAxisFont
Data type Font

Range Axis Color — Color used on the range axis.

Scripting name rangeAxisColor
Data type Color

Range Axis Location — Location of the range axis.

Scripting name rangeAxisLocation
Data type int
Values 0 Top
1 Bottom

Range Axis Lower Margin — Lower margin of the range axis.

Scripting name rangeAxisLowerMargin
Data type double

Range Axis Upper Margin — Upper margin of the range axis.

Scripting name rangeAxisUpperMargin
Data type double

Show Range Axis — Sets whether or not the range axis is visible.

Scripting name rangeAxisVisible
Data type boolean

Uncategorized

Properties Loading — The number of properties currently being loaded

Scripting name propertiesLoading
Data type int
Flags bindable | read-only

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

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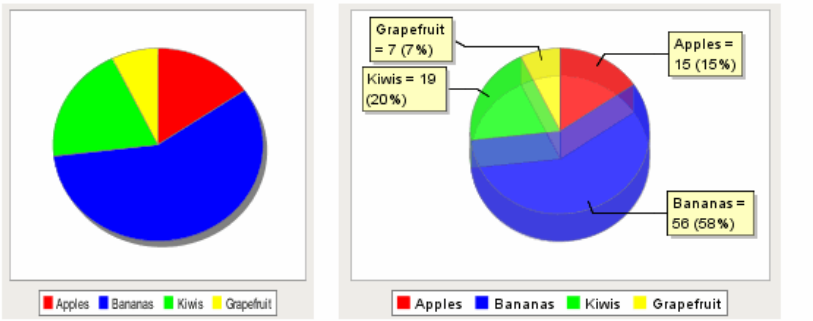
mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.5.7 Pie Chart



Description

The Pie Chart component displays a familiar-looking pie chart. A Pie Chart displays a list of named items, each of which has a value that is part of a total. The total is the sum of the value of each item. The key to the Pie Chart component is the *Data* property, which contains the items that will be displayed as pie wedges. Typically, this dataset will be bound to a SQL Query Binding to pull dynamic data out of an external database.

Extract Order

Similar to other charts, the pie chart can actually accept data in two formats. You can tell the pie chart which format to use via its *Extract Order* property. The two extract orders are `By Column` or `By Row`. The following table shows the two styles for the data that created the pie chart in the screenshot.

By Column		By Row			
Label	**Value**	**Grapefruit**	**Apples**	**Bananas**	**Kiwis**
Grapefruit	7	7	15	56	19
Apples	15				
Bananas	56				
Kiwis	19				

Labels

In addition to the color-coded legend, the pie chart can annotate each wedge with a label. The format of the label is controlled via the *Label Format* property. For example, the format string used in the screenshot is "`{0} = {2} ({3})`"

This is a pattern string that uses the following placeholders:

`{0}` - the item label
`{1}` - the item value
`{2}` - the item percentage

Properties

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Appearance

Chart Title
An optional title that will appear at the top of the chart.
Scripting name `title`
Data type String

Plot Background
The backgroud color for all plots, unless they override it
Scripting name `plotBackground`
Data type Color

Section Colors
The colors to use for the pie wedge fills.
Scripting name `sectionColors`
Data type Color[]

Outline Colors
The colors to use for the pie wedge outlines.
Scripting name `outlineColors`
Data type Color[]

Outline Stroke
The width for the section outline stroke.
Scripting name `outlineStroke`
Data type float

Legend?
Should there be an item legend below the chart?
Scripting name `legend`
Data type boolean

Labels?
Should labels be displayed near sections?
Scripting name `labels`
Data type boolean

Label Format
Formatting String. '{0}' is the wedge name, '{1}' is the value, '{2}' is the percent.
Scripting name `labelFormat`
Data type String

Tooltip Format
Formatting String. '{0}' is the wedge name, '{1}' is the value, '{2}' is the percent.
Scripting name `tooltipFormat`
Data type String

Legend Font
The font for legend items, if there is a legend.
Scripting name `legendFont`
Data type Font

Label Font
The font for labels items, if there are labels.
Scripting name `labelFont`
Data type Font

Title Font
The font for the chart's title.
Scripting name `titleFont`
Data type Font

Starting Angle
The start angle to draw the pie wedges.
Scripting name `startAngle`
Data type int

Rotation
Draw the wedges clockwise or counter-clockwise from the starting angle?

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Scripting name `rotation`
Data type int
Values
0 Clockwise
1 Counter-Clockwise

Enforce Circularity?

If true, the pie cannot be an oval, even if the overall chart is.

Scripting name `circular`
Data type boolean

Style

Style of pie chart, standard, 3D, or ring.

Scripting name `style`
Data type int
Values
0 Pie
1 3D Pie
2 Ring

3D?

Deprecated. Use Style property instead.

Scripting name `threeDimensional`
Data type boolean
Flags expert

Foreground Transparency

The transparency of the pie (useful for 3D pies)

Scripting name `foregroundAlpha`
Data type double

3D Depth Factor

The depth of a 3D pie as a factor of the chart height

Scripting name `depthFactor`
Data type double

Selection Highlight Color

The color of the selection highlight

Scripting name `selectionHighlightColor`
Data type Color
Flags expert

Selection Highlight Width

The line width of the selection highlight

Scripting name `selectionHighlightWidth`
Data type float
Flags expert

Behavior

Tooltips?

Should tooltips be displayed when the mouse hovers over sections?

Scripting name `tooltips`
Data type boolean

Selection Enabled?

If true, the user will be able to select wedges on the chart. The selected wedge will be highlighted, and the "selectedData" property will reflect it.

Scripting name `selectionEnabled`
Data type boolean

Common

Name

The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible

If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

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Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor
The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Flags	expert
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Data
The data driving the chart.

Scripting name	`data`
Data type	Dataset
Flags	bindable

Extract Order
Controls whether or not a pie plot views columns as pies, or rows.

Scripting name	`extractOrder`
Data type	int
Values	**0** By Column **1** By Row

Selected Wedge
The currently selected wedge

Scripting name	`selectedData`
Data type	String
Flags	bindable | read-only

Data Quality
The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion

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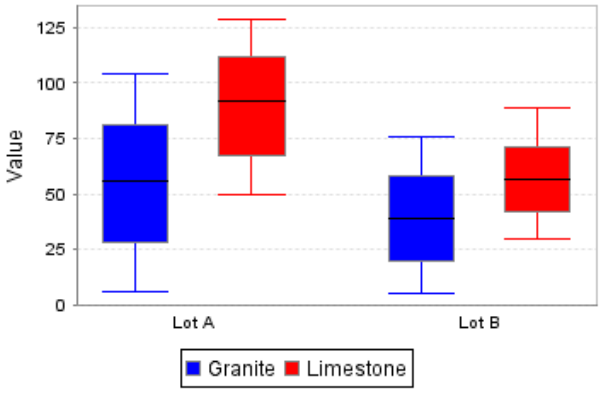
propertyChange

Scripting Functions

This component has no special scripting functions.

9.5.8 Box and Whisker Chart



Description

A Box and Whisker chart displays pertinent statistical information about sets of data. Each box represents a set of numbers. The upper and lower bounds of the box represent the 1st and 3rd quartiles. The line inside the box represents the median. The extends of the "whiskers" represent the max and min outliers. For a more detailed description, see http://mathworld.wolfram.com/Box-and-WhiskerPlot.html.

The configuration for setting up a box and whisker chart, like most charts, is populating the *Data* property. The dataset for a box and whisker chart contains sets of numbers. Each column defines a *series* of values, for which a "box" will be calculated. The column headers define the name for the box. You may also have an optional first column that is a String column, which can break up the series into categories. For example, the data that generated the plot in the screenshot would have looked like this:

Key (String)	**Granite** (Integer)	**Limestone** (Integer)
Lot A	23	39
Lot A	24	23
Lot A	93	54
Lot A	76	72
Lot B	21	83
Lot B	4	21
Lot B	76	98
Lot B	89	102

Properties

Appearance

Font	Font of text of this component Scripting name `font` Data type Font
Chart Title	An optional title that will appear at the top of the chart.

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Scripting name `title`
Data type String

Value Axis Title — A text label to display on the value axis.

Scripting name `valueAxisTitle`
Data type String

Category Axis Title — A text label to display on the category axis.

Scripting name `categoryAxisTitle`
Data type String

Series Colors — The colors to paint each box in a series.

Scripting name `seriesColors`
Data type Color[]

Plot Background — The backgroud color for the plot.

Scripting name `plotBackground`
Data type Color

Fill Boxes? — Fill the boxs with their color?

Scripting name `fillBoxes`
Data type boolean

Legend? — Show a legend on the chart?

Scripting name `legend`
Data type boolean

Behavior

Tooltips? — Show tooltips on tasks?

Scripting name `tooltips`
Data type boolean

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Flags expert
Values
`0` Default
`1` Crosshair

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2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Data

The data driving the chart.

Scripting name	`data`
Data type	Dataset

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

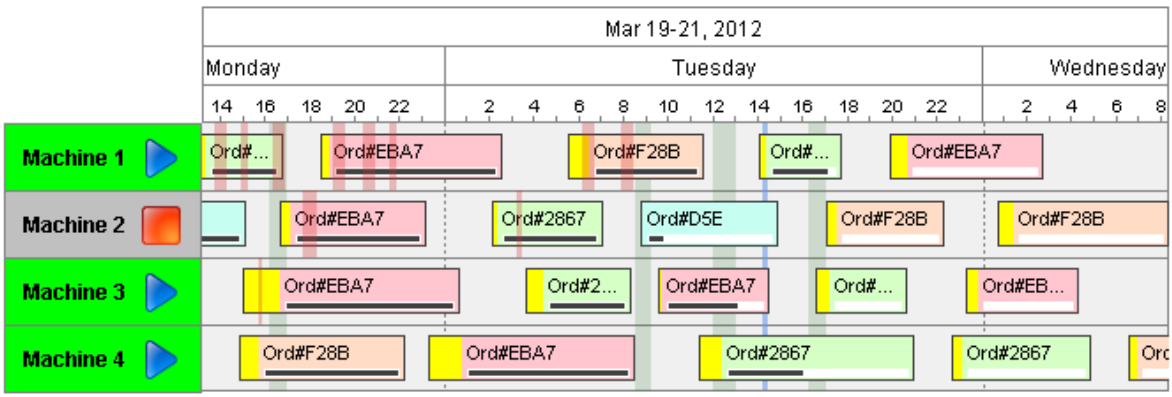
The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

9.5.9 Equipment Schedule



Description

The equipment schedule view is a mix between the status chart, gantt chart, and a calendar view. It conveys a lot of information about equipment, including current status, production schedule, production status, scheduled and unexpected downtime.

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The equipment schedule is powered by four datasets. Information is retrieved from the datasets by column name, case-insensitive. The order of the columns is not important. Optional columns may be omitted.

The "Items" Dataset

Describes the "items" or "cells" to display schedules for. Each entry in this dataset will become a row of the chart.

Name	Type	Optional	Description
ID	Any	N	The identifier for this item. May be any type, will referenced by each entry in the Scheduled Events dataset.
Label	String	N	The text to display in the header
Foreground	Color	Y	Text color
Background	Color	Y	Background color
StatusImagePath	String	Y	A path to an image to display to the right of the header label.

The "Scheduled Items" Dataset

Lists the scheduled events for each item described in the "Items" dataset. Each scheduled event can have a colored lead, or change-over time, a label, a background color, and a progress.

Name	Type	Optional	Description
EventId	String	Y	An identifier for the event, used for event selection.
ItemId	Any	N	The ID of the item to correlate this event with. If no such item is found, the event won't be shown.
Label	String	N	The text ot display in the event's box
StartDate	Date	N	The start-time for the event
EndDate	Date	N	The end-time for the event
Foreground	Color	Y	The text color of the event
Background	Color	Y	The background color of the event
LeadTime	Integer	Y	Time, in seconds, to display as lead time.
LeadColor	Color	Y	The color for the lead time, if any.
PctDone	Number	Y	A value from 0 to 100 to be displayed as a progress bar, use -1 to hide progress bar.

The "Downtime" Dataset

Entries in this dataset will be displayed as simple colored overlays on top of the events, correlated against an item defined in the "Items" dataset.

Name	Type	Optional	Description
ItemId	Any	N	The ID of the item to correlate this downtime event with. If no such item is found, the downtime event won't be shown.
StartDate	Date	N	The start-time for the downtime event
EndDate	Date	N	The start-time for the downtime event
Color	Color	Y	The color to use, typically transparent.
Layer	Integer	Y	0 or 1, with 0 meaning that the rectangle gets painted below the events, and 1 means it will be painted above the events.

The "Breaks" Dataset

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Entries in this dataset will be displayed as colored underlays beneath all events.

Name	Type	Optional	Description
StartDate	Date	N	The start-time for the break event
EndDate	Date	N	The start-time for the break event
Color	Color	Y	The color to use

Properties

Appearance

Event Border
The normal border for a scheduled event
Scripting name `eventBorder`
Data type Border

Selected Event Border
The border for a selected scheduled event
Scripting name `selectedEventBorder`
Data type Border

Row Height
The height of each event's schedule row
Scripting name `lineHeight`
Data type int

Event Margin
The margin to leave visible above and below a scheduled event.
Scripting name `scheduledEventMargin`
Data type int

Schedule Background
The background color of the schedule area
Scripting name `scheduleBackground`
Data type Color

Current Time Color
The color of the current time indicator
Scripting name `nowColor`
Data type Color

Line Color
The color of separating lines in the schedule.
Scripting name `lineColor`
Data type Color

Header Font
The font of the text in the header timeline.
Scripting name `headerFont`
Data type Font

Header Text Color
The color of the text in the header timeline.
Scripting name `headerTextColor`
Data type Color

Header Background
The color of the background for the header timeline.
Scripting name `headerBackground`
Data type Color

Progress Bar Background
The background color for the event progress bars
Scripting name `progressBackground`
Data type Color

Progress Bar Fill
The color for 'done' portion the event progress bars
Scripting name `progressFill`
Data type Color

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Progress Bar Border
The border color for the event progress bars
Scripting name progressBorder
Data type Color

Header Item Font
The font to use for the header items' labels.
Scripting name itemFont
Data type Font

Event Font
The font to use for the event labels.
Scripting name eventFont
Data type Font

Behavior

Drag Enabled
Controls whether or not scheduled events can be dragged for rescheduling.
Scripting name dragEnabled
Data type boolean

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name componentEnabled
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name border
Data type Border

Data

Items
The cells, or equipment items, to have their schedules displayed.
Scripting name items
Data type Dataset
Flags bindable

Scheduled Events
The scheduled events for all configured items
Scripting name scheduledEvents
Data type Dataset
Flags bindable

Downtime Events
Downtime events correlated to a specific item
Scripting name downtimeEvents
Data type Dataset
Flags bindable

Break Events
Scheduled breaks, which will appear as downtime for all items.
Scripting name breakEvents
Data type Dataset

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	Flags	bindable
Start Date	The beginning of the time range to display.	
	Scripting name	`startDate`
	Data type	Date
	Flags	bindable
End Date	The end of the time range to display.	
	Scripting name	`endDate`
	Data type	Date
	Flags	bindable
Selected Event ID	The ID of the selected event.	
	Scripting name	`selectedEvent`
	Data type	String
	Flags	bindable

Scripting

Events

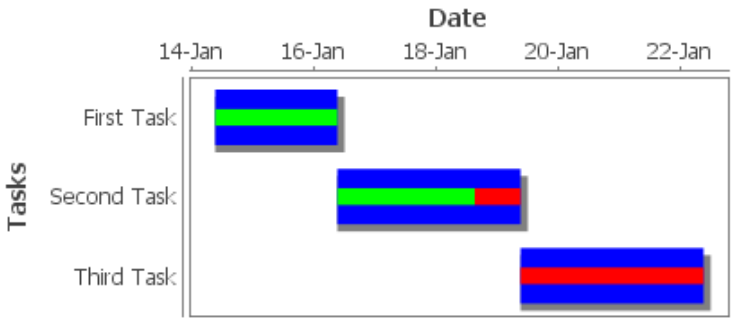
The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- scheduleDrop
- propertyChange

Scripting Functions

This component has no special scripting functions.

9.5.10 Gantt Chart



Description

A Gantt chart is used for task scheduling. It shows a list of named tasks, each of which have a start date, an end date, and a percentage complete. This allows an easy way to visualize tasks, workflows, and scheduling.

The Gantt chart is configured by populating its *Data* property. Each row of the dataset represents a task. There should be four columns: the task label, the start date, the end date, and the percentage (0-100) complete.

Properties

Appearance

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Chart Title — An optional title that will appear at the top of the chart.

Scripting name `title`
Data type String

Task Axis Title

Scripting name `taskAxisTitle`
Data type String

Date Axis Title

Scripting name `dateAxisTitle`
Data type String

Task Color — The main color to draw tasks

Scripting name `taskColor`
Data type Color

Complete Color — The color to draw the amount completed in.

Scripting name `completeColor`
Data type Color

Incomplete Color — The color to draw the amount remaining to do in.

Scripting name `incompleteColor`
Data type Color

Plot Background — The backgroud color for the plot.

Scripting name `plotBackground`
Data type Color

Behavior

Tooltips? — Show tooltips on tasks?

Scripting name `tooltips`
Data type boolean

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Flags expert

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Values	0	Default
	1	Crosshair
	2	Text
	3	Wait
	12	Hand
	13	Move
	4	SW Resize
	5	SE Resize
	6	NW Resize
	7	NE Resize
	8	N Resize
	9	S Resize
	10	W Resize
	11	E Resize

Data

Data

The data driving the chart.

Scripting name	`data`
Data type	Dataset

Data Quality

The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

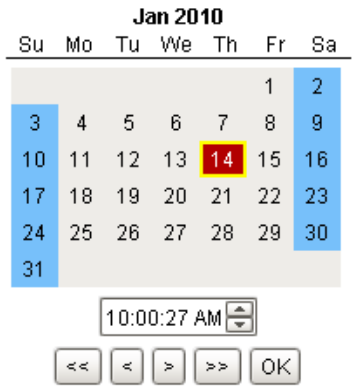
mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.6 Calendar

9.6.1 Calendar



Description

Displays a calendar and time input directly embedded in your window. Most commonly used by

including one of the two date properties (immediate or latched) from the calendar in dynamic SQL Query Bindings.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

Today Foreground — Foreground color for the today indicator.

Scripting name	`todayForeground`
Data type	Color

Today Background — Background color for the today indicator.

Scripting name	`todayBackground`
Data type	Color

Weekend Foreground — Foreground color for the weekend indicators.

Scripting name	`weekendForeground`
Data type	Color

Weekend Background — Background color for the weekend indicators.

Scripting name	`weekendBackground`
Data type	Color

Selected Border — The border for the selected day indicator.

Scripting name	`selectedBorder`
Data type	Border

Title Background — The background of the title bar

Scripting name	`titleBackground`
Data type	Color

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Time Style — Select how this calendar should treat the time portion of the date.

Scripting name	`timeStyle`
Data type	int
Values	**0** User Selectable
	1 Start of Day
	2 End of Day

Show OK Button — Turn this off if you don't want to show the OK button. The latched date and the immediate date will be equivalent.

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Scripting name `showOkButton`
Data type boolean

Show Time — Turn this off if you don't want to show the time panel.

Scripting name `showTime`
Data type boolean

Format String — The date formatting pattern used to format the string versions of the dates.

Scripting name `format`
Data type String

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Enabled — If disabled, a component cannot be used.

Scripting name `componentEnabled`
Data type boolean

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name `opaque`
Data type boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

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Date (immediate)	The date as it is selected right now. Scripting name `date` Data type Date Flags bindable
Date (latched)	The date the last time "OK" was pressed. Scripting name `latchedDate` Data type Date Flags bindable
Formatted Date	The date property, as formatted by the format string. Scripting name `formattedDate` Data type String Flags bindable
Formatted Latched Date	The latched date property, as formatted by the format string. Scripting name `formattedLatchedDate` Data type String Flags bindable
Data Quality	The data quality code for any tag bindings on this component. Scripting name `dataQuality` Data type int Flags bindable | expert

Scripting

Events

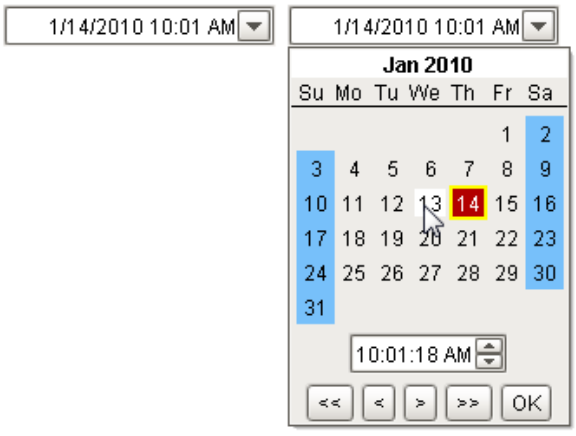
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.6.2 Popup Calendar



A Popup Calendar in both collapsed and popup states

Description

The popup calendar is a popular way to provide date/time choosing controls on a window. Similar to the Calendar component, but takes up much less screen real estate. Most commonly used by including this component's *Date* property in dynamic SQL Query Bindings.

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Foreground Color — The foreground color of the component.

Scripting name	`foreground`
Data type	Color

Background Color — The background color of the component.

Scripting name	`background`
Data type	Color

Today Foreground — Foreground color for the today indicator.

Scripting name	`todayForeground`
Data type	Color

Today Background — Background color for the today indicator.

Scripting name	`todayBackground`
Data type	Color

Weekend Foreground — Foreground color for the weekend indicators.

Scripting name	`weekendForeground`
Data type	Color

Weekend Background — Background color for the weekend indicators.

Scripting name	`weekendBackground`
Data type	Color

Selected Border — The border for the selected day indicator.

Scripting name	`selectedBorder`
Data type	Border

Title Background — The background of the title bar

Scripting name	`titleBackground`
Data type	Color

Calendar Background — The background color for the popup calendar

Scripting name	`calendarBackground`
Data type	Color

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Time Style — Select how this calendar should treat the time portion of the date.

Scripting name	`timeStyle`

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Data type int
Values
0 User Selectable
1 Start of Day
2 End of Day

Show OK Button
Turn this off if you don't want to show the OK button. The latched date and the immediate date will be equivalent.
Scripting name showOkButton
Data type boolean

Show Time
Turn this off if you don't want to show the time panel.
Scripting name showTime
Data type boolean

Format String
The date formatting pattern used to display this date.
Scripting name format
Data type String

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name componentEnabled
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name border
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name toolTipText
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name cursorCode
Data type int
Values
0 Default
1 Crosshair
2 Text
3 Wait
12 Hand
13 Move
4 SW Resize
5 SE Resize
6 NW Resize
7 NE Resize
8 N Resize
9 S Resize
10 W Resize
11 E Resize

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Data

Date	The date that this component represents
Scripting name	`date`
Data type	Date
Flags	bindable
Text	The displayed text of the date (depends on the format string).
Scripting name	`text`
Data type	String
Flags	bindable | expert
Data Quality	The data quality code for any tag bindings on this component.
Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

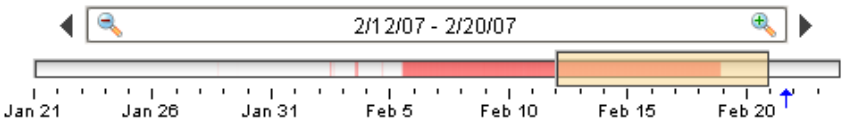
The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

9.6.3 Date Range



Description

The date range component provides an intuitive, drag-and-drop way to select a contiguous range of time. The user is shown a timeline and can drag or stretch the selection box around on the timeline. The selected range is always a whole number of units, where the unit is determined by the current zoom level. For instance, in the screenshot the selected range is Feb 12, 2007 through Feb 20, 2007. This means from the *beginning* of the 12th through the *end* of the 20th.

Using this component is as simple as using the *Start Date* and *End Date* properties that the component provides. Typically, you'll include these dates in a dynamic SQL query binding that drives whatever you're using the date range for, such as a table or chart. For instance, your query binding might look like this:

```
SELECT Column1, Column2, Column3
FROM MyTable WHERE
  t_stamp >= {Root Container.Date Range.startDate} AND
  t_stamp <= {Root Container.Date Range.endDate}
```

Data Density Histogram

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As an advanced optional feature, the date range can display a *data density histogram* inside the timeline. This is useful for historical data with gaps in it, so that the end user isn't hunting for data. (Tip: this is also great for demos, to make it easy to find historical data in a database that isn't being continously updated).

To use this feature, bind the *Data Density* dataset to a query that returns just the timestamps of the target table. These timestamps will be used to fill in the histogram behind the timeline. You can use the *Outer Range Start Date* and *Outer Range End Date* properties in your query to limit the overall return size for the query.

Properties

Appearance

Font
Font of text of this component
Scripting name `font`
Data type Font

Foreground Color
The foreground color of the component.
Scripting name `foreground`
Data type Color

Background Color
The background color of the component.
Scripting name `background`
Data type Color

Today Color
The color of the "Today Arrow" indicator
Scripting name `todayIndicatorColor`
Data type Color

Editor Background
The background color of the textual date range editor portion of this component.
Scripting name `editorBackground`
Data type Color

Box Fill
The fill color for the selection box.
Scripting name `boxFill`
Data type Color
Flags expert

Selection Highlight
The focus highlight color for the selection box
Scripting name `selectionHighlight`
Data type Color
Flags expert

Track Margin
The amount of room on either side of the slider track. May need adjusting of default font is changed.
Scripting name `trackMargin`
Data type int
Flags expert

High Density Color
The color used to indicate high data density.
Scripting name `highDensityColor`
Data type Color

Date Style
The style to display dates in. For international support.
Scripting name `dateStyle`
Data type int

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Flags	expert
Values	0 Auto 1 MDY 2 DMY 3 YMD

Time Style — The style to display times of day. For international support.

Scripting name	timeStyle
Data type	int
Flags	expert
Values	15 Auto 16 12 HR 17 24 HR

Styles — Contains the component's styles

Scripting name	styles
Data type	Dataset
Flags	bindable | expert

Behavior

Startup Mode — Controls whether or not this date range automatically assigns itself a starting range based on the current time

Scripting name	startupMode
Data type	int
Values	0 None 1 Automatic

Startup Range — If startup mode is Automatic, this will be the starting range of time available for selection.

Scripting name	startupRange
Data type	String

Startup Selection — If startup mode is Automatic, this will be the starting selected range.

Scripting name	startupSelection
Data type	String

Max Selection — The maximum size of the selected date range

Scripting name	maxSelectionSize
Data type	String

Tick Density — This is multiplied by the width to determine the current ideal tick unit.

Scripting name	tickDensity
Data type	float
Flags	expert

Common

Name — The name of this component.

Scripting name	name
Data type	String
Flags	bindable

Enabled — If disabled, a component cannot be used.

Scripting name	componentEnabled
Data type	boolean

Visible — If disabled, the component will be hidden.

Scripting name	visible
Data type	boolean

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Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Opaque
If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	`opaque`
Data type	boolean

Cursor
The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Start Date
The starting date of the currently selected range.

Scripting name	`startDate`
Data type	Date
Flags	bindable

End Date
The ending date of the currently selected range.

Scripting name	`endDate`
Data type	Date
Flags	bindable

Outer Range Start
The starting date of the available outer range.

Scripting name	`outerRangeStartDate`
Data type	Date
Flags	bindable | expert

Outer Range End
The ending date of the available outer range.

Scripting name	`outerRangeEndDate`
Data type	Date
Flags	bindable | expert

Data Density
A dataset that is used to calculate a histogram of data density

Scripting name	`densityData`
Data type	Dataset

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Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

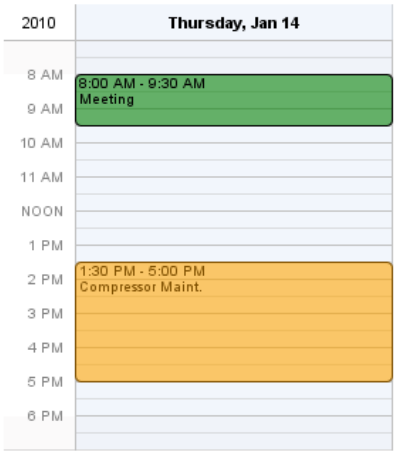
The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.6.4 Day View



Description

This component displays a timeline for a single day, similar to what you might find in a personal planner/organizer. By filling in the *Calendar Events* dataset property, the component will display events that occur on this day. Each event can have custom text and a custom display color associated with it. The format of the dataset requires 4 columns, as demonstrated by the following dataset:

StartDate (Date)	**EndDate** (Date)	**DisplayColor** (String)	**Display** (String)
2010-01-10 8:00:00	2010-01-10 9:30:00	color(0,180,0)	Meeting
2010-01-10 13:30:00	2010-01-10 17:00:00	orange	Compressor Maint.

Properties

Appearance

Working Start Hour — The start hour of a working day

Scripting name	`workingStartHour`
Data type	int
Flags	bindable

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Working End Hour — The end hour of a working day

Scripting name	`workingEndHour`
Data type	int
Flags	bindable

24 Hour Format — Whether or not to show 24 hour or 12 hour format

Scripting name	`twentyFourHour`
Data type	boolean
Flags	bindable

Zoom — Zooms into the specified zoom time-range

Scripting name	`autoZoom`
Data type	boolean
Flags	bindable

Zoomed Start Hour — The start hour zoomed in

Scripting name	`autoZoomStartHour`
Data type	int
Flags	bindable

Zoomed End Hour — The end hour zoomed in

Scripting name	`autoZoomEndHour`
Data type	int
Flags	bindable

Grid marks — Set the amount of grid lines

Scripting name	`gridMarks`
Data type	int
Flags	bindable

Week Day Foreground Color — The color of the week day's text.

Scripting name	`weekDaysForeground`
Data type	Color
Flags	bindable

Week Day Background Color — The color of the week day's background

Scripting name	`weekDaysBackground`
Data type	Color
Flags	bindable

Calendar Background Color — The color of the calendar's background.

Scripting name	`calendarBackground`
Data type	Color
Flags	bindable

Day Outline Color — The color of the day's outline

Scripting name	`boxOutline`
Data type	Color
Flags	bindable

Today's Background Color — The color of the today's background

Scripting name	`todayBackground`
Data type	Color
Flags	bindable

Hover Background Color — The background color of the hovered time

Scripting name	`hoverBackground`
Data type	Color

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Flags bindable

Hour Foreground Color

The foreground color for hours in a day

Scripting name `hourForeground`
Data type Color
Flags bindable

Non-Working Hours Background Color

The background color for the non-working hours of the day

Scripting name `nonWorkingHourBackground`
Data type Color
Flags bindable

Styles

Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name

The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible

If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
- `0` Default
- `1` Crosshair
- `2` Text
- `3` Wait
- `12` Hand
- `13` Move
- `4` SW Resize
- `5` SE Resize
- `6` NW Resize
- `7` NE Resize
- `8` N Resize
- `9` S Resize
- `10` W Resize
- `11` E Resize

Data

Year

Set the calendar's year

Scripting name `year`

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Data type	int
Flags	bindable

Month — Set the calendar's month

Scripting name	`month`
Data type	int
Flags	bindable

Day — Set the calendar's day

Scripting name	`day`
Data type	int
Flags	bindable

Calendar events — Contains the calendar events

Scripting name	`events`
Data type	Dataset
Flags	bindable

Hovered Time — The calendar's hovered time

Scripting name	`hoveredTime`
Data type	String
Flags	bindable

Selected Event — The calendar's selected event

Scripting name	`selectedEvent`
Data type	int
Flags	bindable

Hovered Event — The calendar's hovered event

Scripting name	`hoveredEvent`
Data type	int
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

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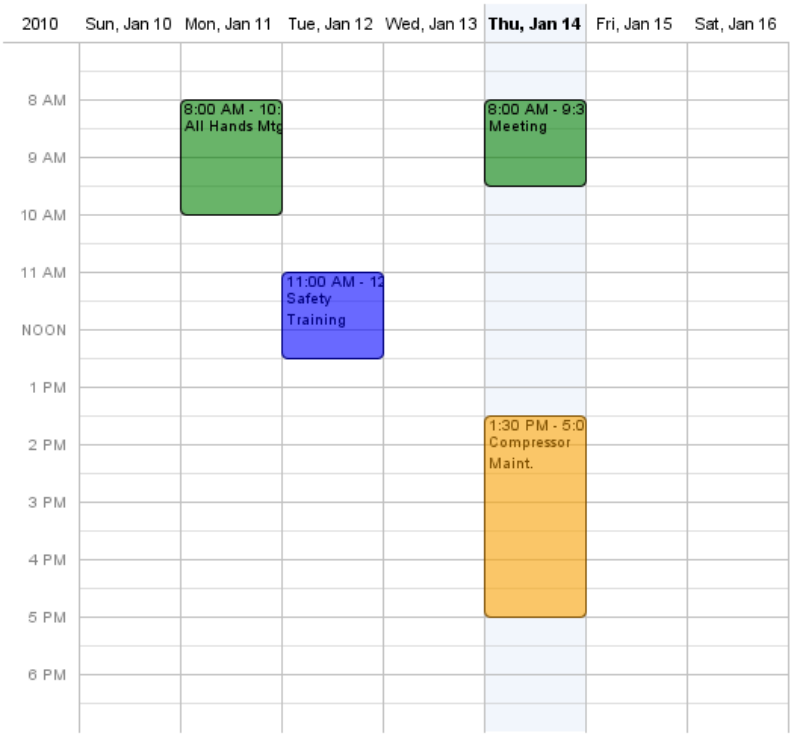
9.6.5 Week View



Description

Displays a full week's worth of events on a calendar. Configuration is achieved by populating the *Calendar Events* dataset. See the Day View for details.

Properties

Appearance

Working Start Hour — The start hour of a working day

Scripting name	`workingStartHour`
Data type	int
Flags	bindable

Working End Hour — The end hour of a working day

Scripting name	`workingEndHour`
Data type	int
Flags	bindable

24 Hour Format — Whether or not to show 24 hour or 12 hour format

Scripting name	`twentyFourHour`
Data type	boolean
Flags	bindable

Show Weekend? — Whether or not to show Saturday and Sunday

Scripting name	`showWeekend`
Data type	boolean
Flags	bindable

Zoom — Zooms into the specified zoom time-range

Scripting name	`autoZoom`

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	Data type	boolean
	Flags	bindable
Zoomed Start Hour	The start hour zoomed in	
	Scripting name	`autoZoomStartHour`
	Data type	int
	Flags	bindable
Zoomed End Hour	The end hour zoomed in	
	Scripting name	`autoZoomEndHour`
	Data type	int
	Flags	bindable
Grid marks	Set the amount of grid lines	
	Scripting name	`gridMarks`
	Data type	int
	Flags	bindable
Week Day Foreground Color	The color of the week day's text.	
	Scripting name	`weekDaysForeground`
	Data type	Color
	Flags	bindable
Week Day Background Color	The color of the week day's background	
	Scripting name	`weekDaysBackground`
	Data type	Color
	Flags	bindable
Calendar Background Color	The color of the calendar's background.	
	Scripting name	`calendarBackground`
	Data type	Color
	Flags	bindable
Day Outline Color	The color of the day's outline	
	Scripting name	`boxOutline`
	Data type	Color
	Flags	bindable
Today's Background Color	The color of the today's background	
	Scripting name	`todayBackground`
	Data type	Color
	Flags	bindable
Selected Background Color	The color of the selected day's background	
	Scripting name	`selectedBackground`
	Data type	Color
	Flags	bindable
Hover Background Color	The background color of the hovered day and time	
	Scripting name	`hoverBackground`
	Data type	Color
	Flags	bindable
Hour Foreground Color	The foreground color for hours in a day	
	Scripting name	`hourForeground`
	Data type	Color
	Flags	bindable
Non-Working Hours	The background color for the non-working hours of the day	

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Background Color

Scripting name nonWorkingHourBackground
Data type Color
Flags bindable

Styles

Contains the component's styles

Scripting name styles
Data type Dataset
Flags bindable | expert

Common

Name

The name of this component.

Scripting name name
Data type String
Flags bindable

Visible

If disabled, the component will be hidden.

Scripting name visible
Data type boolean

Border

The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name border
Data type Border

Mouseover Text

The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name toolTipText
Data type String

Cursor

The mouse cursor to use when hovering over this component.

Scripting name cursorCode
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Year

Set the calendar's year

Scripting name year
Data type int
Flags bindable

Month

Set the calendar's month

Scripting name month
Data type int
Flags bindable

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Day — Set the calendar's day

Scripting name	`day`
Data type	int
Flags	bindable

Calendar events — Contains the calendar events

Scripting name	`events`
Data type	Dataset
Flags	bindable

Selected Day — The calendar's selected day

Scripting name	`selectedDay`
Data type	String
Flags	bindable

Hovered Day — The calendar's hovered day

Scripting name	`hoveredDay`
Data type	String
Flags	bindable

Hovered Time — The calendar's hovered time

Scripting name	`hoveredTime`
Data type	String
Flags	bindable

Selected Event — The calendar's selected event

Scripting name	`selectedEvent`
Data type	int
Flags	bindable

Hovered Event — The calendar's hovered event

Scripting name	`hoveredEvent`
Data type	int
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

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9.6.6 Month View

Description

Displays a month's worth of events on a calendar. Configuration is achieved by populating the *Calendar Events* dataset. See the Day View for details.

Properties

Appearance

Header Font — The font of the header's text.

Scripting name	`headerFont`
Data type	Font

Event Display Mode — Affects how events are displayed.Standard Mode: Displays each eventHighlight Mode: Highlights each day that contains events using the event highlight background color.

Scripting name	`displayMode`
Data type	int
Flags	bindable
Values	1 Standard 2 Highlight

Event Highlight Background — The background color of a day with events. Used only in highlight mode.

Scripting name	`highlightBackground`
Data type	Color
Flags	bindable

Header Foreground Color — The color of the header's text.

Scripting name	`monthHeaderForeground`
Data type	Color
Flags	bindable

Header Background Color — The color of the header's background

Scripting name	`monthHeaderBackground`
Data type	Color

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	Flags	bindable
Week Day Font	The font of the week day's text.	
	Scripting name	`weekdayFont`
	Data type	Font
Week Day Foreground Color	The color of the week day's text.	
	Scripting name	`weekDaysForeground`
	Data type	Color
	Flags	bindable
Week Day Background Color	The color of the week day's background	
	Scripting name	`weekDaysBackground`
	Data type	Color
	Flags	bindable
Calendar Background Color	The color of the calendar's background.	
	Scripting name	`calendarBackground`
	Data type	Color
	Flags	bindable
Today's Background Color	The color of the today's background	
	Scripting name	`todayBackground`
	Data type	Color
	Flags	bindable
Selected Background Color	The color of the selected day's background	
	Scripting name	`selectedBackground`
	Data type	Color
	Flags	bindable
Hover Background Color	The background color of the hovered day	
	Scripting name	`hoverBackground`
	Data type	Color
	Flags	bindable
Day Outline Color	The color of the day's outline	
	Scripting name	`boxOutline`
	Data type	Color
	Flags	bindable
Day Font	The font for the number representing the day of the month.	
	Scripting name	`dayFont`
	Data type	Font
Day Foreground Color	The foreground color for days in this month	
	Scripting name	`dayOfMonthForeground`
	Data type	Color
	Flags	bindable
Day Other Foreground Color	The foreground color for days not in this month	
	Scripting name	`dayOfMonthOtherForeground`
	Data type	Color
	Flags	bindable
Event Font	The font for all calendar events.	
	Scripting name	`eventFont`
	Data type	Font

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Event Background Color — The background color of the selected event

Scripting name	`itemSelBackground`
Data type	Color
Flags	bindable

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Month — Set the calendar's month

Scripting name	`month`
Data type	int
Flags	bindable

Year — Set the calendar's year

Scripting name	`year`
Data type	int

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Flags	bindable

Calendar events — Contains the calendar events

Scripting name	`events`
Data type	Dataset
Flags	bindable

Selected Day — The calendar's selected day

Scripting name	`selectedDay`
Data type	String
Flags	bindable

Hovered Day — The calendar's hovered day

Scripting name	`hoveredDay`
Data type	String
Flags	bindable

Selected Event — The calendar's selected event

Scripting name	`selectedEvent`
Data type	int
Flags	bindable

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

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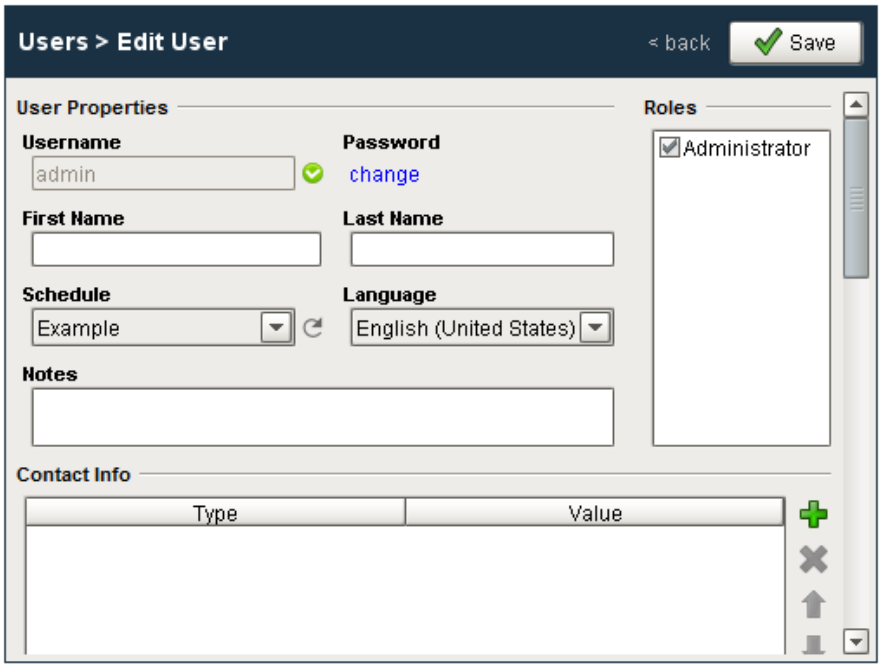
9.7 Admin

9.7.1 User Management



Description

The user management panel provides a built-in way to edit users and roles from a client. To use this component, you should be aware that it is only editing the users and roles from a single *User Source.* By default, the component will use the user source of the containing project. You can change this by typing in the name of another user source into the component's "User Source" property.

This component can be run in one of three *modes*:
***Manage Users* Mode:** In this mode, the component manages all of the users contained in the user source. Users and roles may be added, removed, and edited.
***Edit Single* Mode:** In this mode, the component only edits a single user. Which user is being edited is controlled via the "User Source" and "Username" properties.
***Edit Current* Mode:** In this mode, the user who is currently logged into the project can edit themselves. Obviously, the ability to assign roles is not available in this mode. This can be useful to allow users to alter their own password, adjust their contact information, and update their schedules.

Warning: Be careful to only expose this component to users who should have the privileges to alter other users. Access to this component in "M*anage Users"* mode will allow users to edit other users' passwords and roles.

Properties

Appearance

Show Username Column — Controls whether the user table shows the username column or not.

Scripting name	`columnUsername`
Data type	boolean

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Show Name Column — Controls whether the user table shows the name column or not.

Scripting name	`columnName`
Data type	boolean

Show Contact Info Column — Controls whether the user table shows the contact info column or not.

Scripting name	`columnContactInfo`
Data type	boolean

Show Roles Column — Controls whether the user table shows the roles column or not.

Scripting name	`columnRoles`
Data type	boolean

Show Schedule Column — Controls whether the user table shows the schedule column or not.

Scripting name	`columnSchedule`
Data type	boolean

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Mode — Affects what mode the user management component runs in

Scripting name	`mode`
Data type	int
Flags	bindable
Values	**0** Manage Users **1** Edit Current **2** Edit Single

User Source — The user source to manage users in. If blank, uses the project's default user source.

Scripting name	`userProfile`
Data type	String
Flags	bindable

Username — The name of the user being edited. Read-only except when mode is "Edit Single", in which case it defines the user to be edited.

Scripting name	`username`
Data type	String
Flags	bindable

Role Management Enabled — If true, role management is available.

Scripting name	`allowRoleManagement`
Data type	boolean

Username Editing Enabled — If true, usernames will be editable.

Scripting name	`allowUsernameEditing`
Data type	boolean

Role Assigning Enabled — If true, a user's roles will be editable.

Scripting name	`allowRoleAssigning`
Data type	boolean

Contact Info Editing Enabled — If true, a user's contact info will be editable.

Scripting name	`allowContactInfoEditing`
Data type	boolean

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Schedule Adjustments Enabled
If true, a user's schedule adjustments will be editable.
Scripting name `allowScheduleModifications`
Data type boolean

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Enabled
If disabled, a component cannot be used.
Scripting name `componentEnabled`
Data type boolean

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name `border`
Data type Border

Data

Data Quality
The data quality code for any tag bindings on this component.
Scripting name `dataQuality`
Data type int
Flags bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

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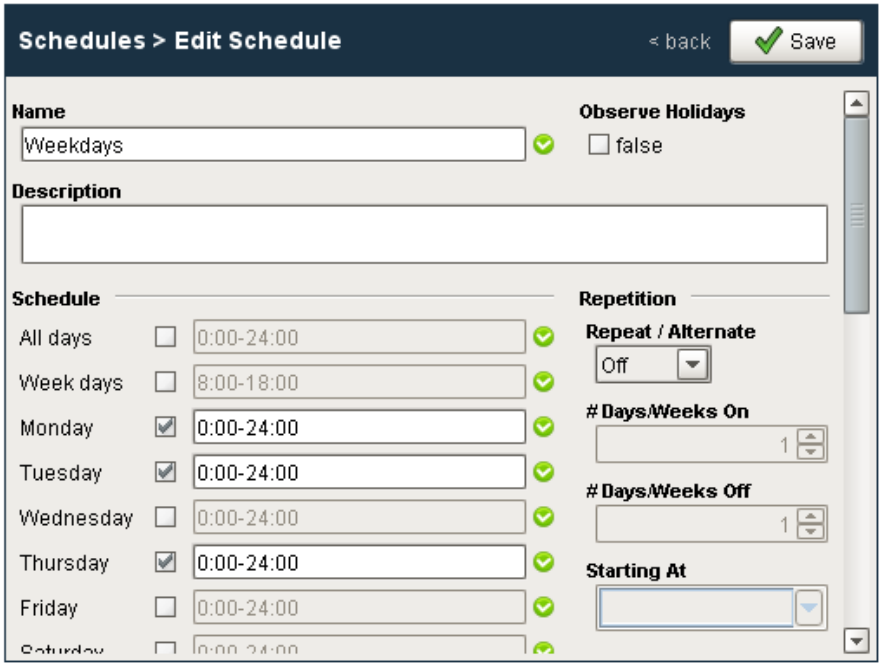
9.7.2 Schedule Management



Description

This component allows for management of schedules. Schedules can be defined by specifying which days of the week and which times of day they are active on. The times of day are defined using a string of time ranges, where the times are specified in 24-hr format with dashes between the beginning and the end. Multiple ranges can be specified by separating them with commas. Examples:

8:00-17:00	Valid from 8am to 5pm
6:00-12:00, 12:45-14:00	Valid from 6am to noon, and then again from 12:45pm to 2pm
0:00-24:00	Always valid.

Schedules that alternate weekly or daily can be specified by using the *repetition* settings. All repeating schedules need a starting day. For example, you could have a schedule that repeats on a weekly basis, with 1-week on and 1-week off. This schedule would be active for seven days starting on the starting day, and then inactive for the next seven days, then active for seven days, and so on. Note that the days of the week and time settings are evaluated in addition to the repetition settings. This means that both settings must be true for the schedule to be active. Also note that if you set "*Repeat / Alternate*" to a setting other than "*Off*" and you do not specify a starting day, the schedule will never be active.

Properties

Appearance

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Common

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Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Enabled — If disabled, a component cannot be used.

Scripting name	`componentEnabled`
Data type	boolean

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Data

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

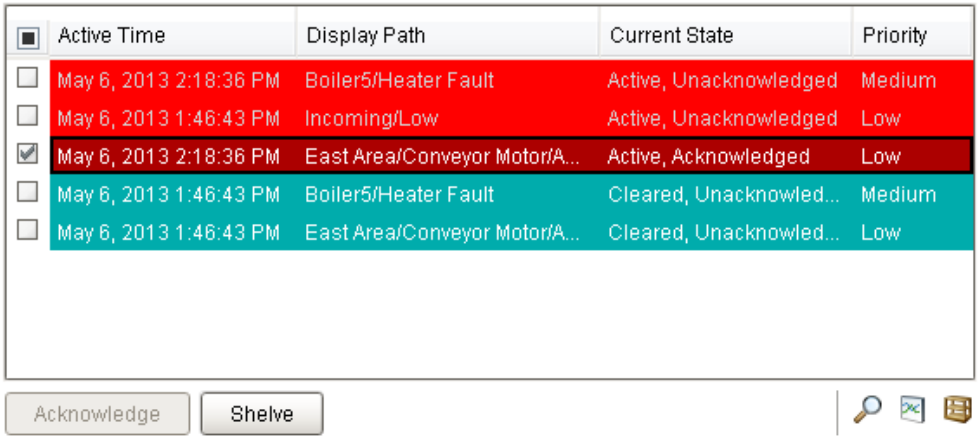
mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.8 Alarming

9.8.1 Alarm Status Table



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Description

The alarm status table displays the current state of the alarm system. It can be configured to show active, unacknowledged, cleared, and acknowledged alarms. By default it shows all non-cleared/non-ack'ed alarms.

Acknowledgement is handled by selecting (checking) alarms and pressing the "*Acknowledge"* button. If any of the selected alarms require acknowledge notes, then a small text area will be presented in which the operator must add notes to the acknowledgement.

Shelving is supported by pressing the "Shelve" button when an alarm is selected. This will temporarily remove the alarm from the entire alarm system (not just the local client). When the time is up, if the alarm is still active, it will pop back into the alarm system. The times shown to the user are customizable by editing the values inside the "*Shelving Times*" dataset property. The alarms that have been shelved can be un-shelved by pushing the shelf management button in the lower right-hand side of the component.

If a more simplified alarm status table is needed, many of the features of the status table can be removed, for example, the header, footer, and multi-selection checkboxes. If a very short alarm status table is needed, turn on the "*Marquee Mode*" option, which will automatically scroll through any alarms if there is not enough vertical space to show all of them at once.

To change the columns that are displayed, the order of the columns, and/or the column width, put the Designer into preview mode. Then right-click on the table header to show/hide columns. Click and drag to re-order columns, and drag the margins of the columns to resize their width. No further action is necessary - the column configuration will remain in place after the window is saved.

For alarms that originate from tags that have tag history turned on, users can see an automatic ad-hoc chart for the value of the source tag by pressing the chart button.

Properties

Appearance

Number Format	A number format string to control the format of the value column.	
	Scripting name	`numberFormat`
	Data type	String
Table Background	The background of the alarm table.	
	Scripting name	`tableBackground`
	Data type	Color
Selection Color	The color of the selection border	
	Scripting name	`selectionColor`
	Data type	Color
Selection Thickness	The size of the selection border	
	Scripting name	`selectionThickness`
	Data type	int
Flash Interval	The time interval to use for flashing row styles.	
	Scripting name	`flashInterval`
	Data type	int
Show Table Header	Toggles visibility of the table's header.	

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Scripting name showTableHeader
Data type boolean

Row Height
The height, in pixels, for each row of the table.
Scripting name rowHeight
Data type int

Show Footer
Show a footer with acknowledge and shelf functions below the alarms.
Scripting name showFooterPanel
Data type boolean

Show Ack Button
Show the acknowledge button on the footer panel.
Scripting name showAck
Data type boolean

Show Shelve Button
Show the shelve button on the footer panel.
Scripting name showShelve
Data type boolean

Show Details Button
Show the view details button on the footer panel.
Scripting name showDetails
Data type boolean

Show Chart Button
Show the chart button on the footer panel.
Scripting name showChart
Data type boolean

Show Manage Shelf Button
Show the manage shelf button on the footer panel.
Scripting name showManageShelf
Data type boolean

Row Styles
A dataset containing the different styles configured for different alarm states.
Scripting name rowStyles
Data type Dataset
Flags bindable | expert

Behavior

Refresh Rate
The rate at which this table will poll changes to the alarm status.
Scripting name refreshRate
Data type long
Flags bindable

Sort Order
The default sort order for alarms in the status table.
Scripting name sortOrder
Data type int
Values
0 State_Time
1 State_Priority_Time
2 Priority_State_Time

Multi Select
Allow multi select. Will show/hide the checkbox column.
Scripting name multiSelect
Data type boolean

Marquee Mode
Turn the table into a scrolling marquee
Scripting name marqueeMode
Data type boolean

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Chart Resolution
The resolution for the ad-hoc tag historian chart.

Scripting name	`chartResolution`
Data type	int

Journal Name
The name of the alarm journal to query for the chart's annotations. Leave this blank to automatically pick the journal if there is only one.

Scripting name	`alarmJournalName`
Data type	String
Flags	expert

Common

Name
The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible
If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Data

Selected Alarms
A dataset containing each selected alarm. (Read-only)

Scripting name	`selectedAlarms`
Data type	Dataset
Flags	bindable | expert

Shelving Times
This dataset holds the times that are suggested when shelving an alarm.

Scripting name	`shelvingTimes`
Data type	Dataset

Data Quality
The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Filters

Min Priority
The minimum priority alarm to be displayed by this table.

Scripting name	`minPriority`
Data type	int
Values	`0` Diagnostic `1` Low `2` Medium `3` High `4` Critical

Show Active and Unacked
Show alarms that are active and unacknowledged.

Scripting name	`activeAndUnacked`
Data type	boolean

Show Active and Acked
Show alarms that are active and acknowledged.

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Scripting name `activeAndAcked`
Data type boolean

Show Clear and Unacked — Show alarms that are cleared and unacknowledged.

Scripting name `clearAndUnacked`
Data type boolean

Show Clear and Acked — Show alarms that are cleared and acknowledged.

Scripting name `clearAndAcked`
Data type boolean

Source Filter — Filter alarms by alarm source path. Specify multiple paths by separating them with commas. Supports the wildcard "*".

Scripting name `sourceFilter`
Data type String

Display Path Filter — Filter alarms by alarm display path, falling back to the source path if display path isn't set. Specify multiple paths by separating them with commas. Supports the wildcard "*".

Scripting name `displayPathFilter`
Data type String

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
focus
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.8.2 Alarm Journal Table

Event Time	Event State	Priority	Ack'ed By	Display Path	Event Value
May 6, 2013 2:18:45 PM	Ack	Low	admin	East Area/Conveyor...	
May 6, 2013 2:18:36 PM	Active	Low		East Area/Conveyor...	1
May 6, 2013 2:18:36 PM	Active	Medium		Boiler5/Heater Fault	1
May 6, 2013 2:18:34 PM	Clear	Medium		Boiler5/Heater Fault	0
May 6, 2013 2:18:31 PM	Clear	Low		East Area/Conveyor...	0
May 6, 2013 1:46:43 PM	Active	Low		East Area/Conveyor...	1
May 6, 2013 1:46:43 PM	Active	Medium		Boiler5/Heater Fault	1
May 6, 2013 1:46:43 PM	Active	Low		Incoming/Low	1
May 6, 2013 1:37:17 PM	Active	Low		Boiler2/Temp	50
May 6, 2013 1:37:17 PM	Ack	Low		Boiler2/Temp	
May 6, 2013 1:37:14 PM	Clear	Low		Boiler2/Temp	44.9613
May 6, 2013 1:37:11 PM	Active	Low		Boiler2/Temp	50

1,549 events

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Description

The alarm journal table provides a built-in view to explore alarm history that has been stored in an alarm journal. If you only have one alarm journal specified on your Gateway, then you do not need to specify the journal name. If you have more than one specified, then you need to provide the name of the journal you'd like to query.

The journal table shows the alarm history that is found between the *Start Date* and *End Date* properties. When you first put an alarm journal table on a window, these properties will be set to show the most recent few hours of journal history. Note that without further configuration, the journal table will always show the few hours before it was created. **To properly configure an alarm journal table,** please bind it's start and end date properties to something what will update, such as the Date Range component or expressions involving the time *now()*. This way, you can configure it so that operators can choose the time to display, or have dates will be update automatically to have it poll.

To change the columns that are displayed, the order of the columns, and/or the column width, put the Designer into preview mode. Then right-click on the table header to show/hide columns. Click and drag to re-order columns, and drag the margins of the columns to resize their width. No further action is necessary - the column configuration will remain in place after the window is saved.

Properties

Appearance

Selection Color — The color of the selection border

Scripting name	`selectionColor`
Data type	Color

Selection Thickness — The size of the selection border

Scripting name	`selectionThickness`
Data type	int

Table Background — The background of the alarm table.

Scripting name	`tableBackground`
Data type	Color

Row Height — The height, in pixels, for each row of the table.

Scripting name	`rowHeight`
Data type	int

Row Styles — A dataset containing the different styles configured for different alarm states.

Scripting name	`rowStyles`
Data type	Dataset
Flags	bindable | expert

Number Format — A number format string to control the format of the value column.

Scripting name	`numberFormat`
Data type	String

Behavior

Journal Name — The name of the alarm journal to query

Scripting name	`journalName`
Data type	String

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Flags bindable

Start Date — The starting date for the displayed history range

Scripting name `startDate`
Data type Date
Flags bindable

End Date — The ending date for the displayed history range

Scripting name `endDate`
Data type Date
Flags bindable

Read Timeout — The timeout, in milliseconds, for running the alarm history query.

Scripting name `readTimeout`
Data type int
Flags expert

Common

Name — The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible — If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Data

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Filters

System Events — Show system events such as startup and shutdown

Scripting name `includeSystemEvents`
Data type boolean

Source Filter — Filter alarms by alarm source path. Specify multiple paths by separating them with commas. Supports the wildcard "*".

Scripting name `sourceFilter`
Data type String

Display Path Filter — Filter alarms by alarm display path, falling back to the source path if display path isn't set. Specify multiple paths by separating them with commas. Supports the wildcard "*".

Scripting name `displayPathFilter`
Data type String

Search String — Filter alarms by searching for a string in both source path and display path.

Scripting name `searchString`

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Data type String

Min Priority — The minimum priority to display.

Scripting name `minimumPriority`
Data type int
Values
0 Diagnostic
1 Low
2 Medium
3 High
4 Critical

Max Priority — The maximum priority to display.

Scripting name `maximumPriority`
Data type int
Values
0 Diagnostic
1 Low
2 Medium
3 High
4 Critical

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

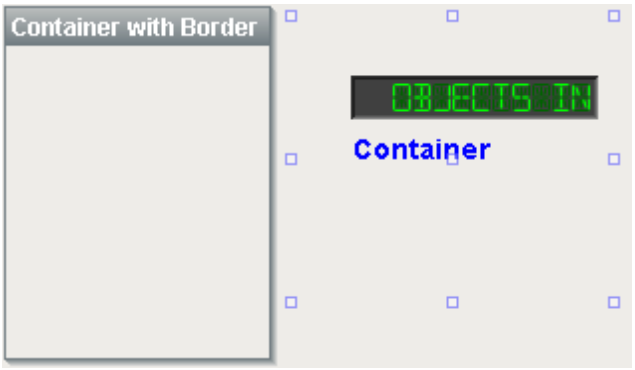
mouse
mouseMotion
focus
propertyChange
key

Scripting Functions

This component has no special scripting functions.

9.9 Misc

9.9.1 Container



Description

The container is a very important component. All components are always inside of a container, except for the special "Root Container" of each window (see Anatomy of a Window). A container is different than normal components in that it can contain other components, including other containers. Uses for containers include:

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Organization. Containers can be used to group components together. These components can then easily be moved, copied, or deleted as a group. Furthermore, they will all be organized inside of their parent container in the project navigation tree, which makes them easier to find.
Re-usability. Containers allow a unique opportunity to create a complex component that is made up of multiple other components. The Container's ability to have dynamic properties aids this greatly. For instance, if you wanted to make your own custom HOA control, you can put three buttons inside of a container and configure them to all use a 'status' property that you add to their parent Container. Now you have built an HOA control that can be re-used and treated like its own component. The possibilities here are endless. Create a date range control that generates an SQL WHERE clause that can be used to control Charts and Tables. Create a label/button control that can be used to display datapoints, and pop up a parameterized window that displays meta-data (engineering units, physical location, notes, etc) about that datapoint. Creating re-usable controls with Containers containing multiple components is the key to rapid application development.
Layout. Containers are a great way to improve window aesthetics through borders and layout options.

Grouping

A container can be set as a "group" by right-clicking on it and choosing "Group Container". This will make the container act like a single component - you won't be able to select its children by clicking on them. This can help make window design easier, as you'll always pick the container by clicking anywhere inside it. You can still get to the individual sub-components by choosing them in the project navigation tree. You can un-group a container at any time by right clicking on it and choosing "Ungroup Container".

See also:
Component Layout
Custom Palettes

Properties

Appearance

Font — Font of text of this component

Scripting name	`font`
Data type	Font

Background Color — Set the color of the background

Scripting name	`background`
Data type	Color
Flags	bindable

Texture — Background texture image for this container.

Scripting name	`texturePath`
Data type	String

Styles — Contains the component's styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable | expert

Behavior

Combine Repaints — Set this to true for containers with many sub-components that need to redraw frequently (flashing, rotating, animating).

Scripting name	`combineRepaints`
Data type	boolean

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Tile Optimized — If true, this container's children should never overlap, and you'll get better painting performance.

Scripting name	`optimizedDrawingEnabled`
Data type	boolean
Flags	expert

Common

Name — The name of this component.

Scripting name	`name`
Data type	String
Flags	bindable

Visible — If disabled, the component will be hidden.

Scripting name	`visible`
Data type	boolean

Border — The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name	`border`
Data type	Border

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Opaque — If false, backgrounds are not drawn. If true, backgrounds are drawn.

Scripting name	`opaque`
Data type	boolean

Cursor — The mouse cursor to use when hovering over this component.

Scripting name	`cursorCode`
Data type	int
Values	**0** Default **1** Crosshair **2** Text **3** Wait **12** Hand **13** Move **4** SW Resize **5** SE Resize **6** NW Resize **7** NE Resize **8** N Resize **9** S Resize **10** W Resize **11** E Resize

Data

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn

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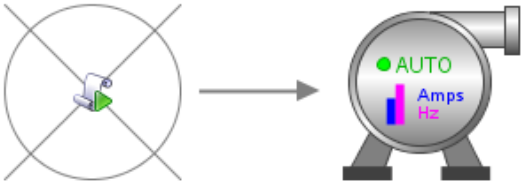
more.
mouse
mouseMotion
propertyChange

Scripting Functions
This component has no special scripting functions.

9.9.2 Paintable Canvas



A paintable canvas in Design and Preview modes

Description

The Paintable Canvas component is a component that can be custom "painted" using Jython scripting. By responding to the component's `repaint` event, a designer can use Java2D to draw anything within the component's bounds. Whenever any dynamic properties on the component change, the component is re-painted automatically, making it possible to create dynamic, vector-drawn components that can represent anything.

This component is an **advanced component** for those who are very comfortable using scripting. It is *not* user-friendly. The upside is that it is extraordinarily powerful, as your imagination is the only limit with what this component can be.

When you first drop a Paintable Canvas onto a window, you'll notice that it looks like a placeholder. If you switch the Designer into *preview* mode, you'll see an icon of a pump displayed. The pump is an example that comes pre-loaded into the Paintable Canvas. By editing the component's event scripts, you can dissect how the pump was drawn. You will notice that the script uses Java2D. You can read more about Java2D here http://java.sun.com/docs/books/tutorial/2d/index.html. You will notice that as you resize the pump, it scales beautifully in preview mode. Java2D is a vector drawing library, enabling you to create components that scale very gracefully.

Tips:
Don't forget that you can add dynamic properties to this component, and use the styles feature.
Use the values of dynamic properties in your repaint code to create a dynamic component. The component will repaint automatically when these values change.
You can create an interactive component by responding to mouse and keyboard events
You can store your custom components on a custom palette and use them like standard components.

See also:
Event Types - repaint

Properties

Appearance

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Font
Font of text of this component
Scripting name font
Data type Font

Foreground Color
The foreground color of the component.
Scripting name foreground
Data type Color

Background Color
The background color of the component.
Scripting name background
Data type Color

Styles
Contains the component's styles
Scripting name styles
Data type Dataset
Flags bindable | expert

Behavior

Focusable
If the component is focusable, it will recieve keyboard input and can detect if it is the focus owner.
Scripting name focusable
Data type boolean
Flags expert

Common

Name
The name of this component.
Scripting name name
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.
Scripting name visible
Data type boolean

Border
The border surrounding this component. NOTE that the border is unaffected by rotation.
Scripting name border
Data type Border

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name toolTipText
Data type String

Cursor
The mouse cursor to use when hovering over this component.
Scripting name cursorCode
Data type int
Values
0 Default
1 Crosshair
2 Text
3 Wait
12 Hand
13 Move
4 SW Resize
5 SE Resize
6 NW Resize
7 NE Resize
8 N Resize

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9	S Resize
10	W Resize
11	E Resize

Data

Data Quality	The data quality code for any tag bindings on this component.
Scripting name	dataQuality
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- focus
- paint
- propertyChange
- key

Scripting Functions

This component has no special scripting functions.

9.9.3 Line

Description

Description missing.

Properties

Appearance

Anti Alias	Draw component using anti-aliasing?
Scripting name	antiAlias
Data type	boolean
Flags	expert
Color	Set the color of the line.
Scripting name	foreground
Data type	Color
Flags	bindable
Line Width	Set the width of the line in pixels.
Scripting name	lineWidth
Data type	int
Flags	bindable
Line Mode	The line mode determines where in the rectangle the line is drawn.
Scripting name	lineMode
Data type	int
Flags	bindable
Values	0 Horizontal/Vertical 1 Uphill (Left-Right) 2 Dow nhill (Left-Right)
Line Style	The line style determines how the shape of the line looks

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Scripting name `lineStyle`
Data type int
Flags bindable
Values
0 Plain
1 Dashed
2 Sinusoidal
3 Sinusoidal-Dashed
4 Loop
5 Loop-Dashed

Dash Pattern
Enter a string of comma-delimited numbers which indicate the stroke pattern for a dashed line. For instance, "3,5" means three pixels on, five pixels off.
Scripting name `strokePattern`
Data type String

Sine Length
Sets the 'wavelength' of the sine wave to be drawn
Scripting name `sineLength`
Data type int

Sine Height
Sets the 'amplitude' of the sine wave to be drawn
Scripting name `sineHeight`
Data type int

Left Arrow
Draw an arrow head on the left/top of the line?
Scripting name `leftArrow`
Data type boolean

Right Arrow
Draw an arrow head on the right/bottom of the line?
Scripting name `rightArrow`
Data type boolean

Left Arrow Size
The size of the left arrow, if present
Scripting name `leftArrowSize`
Data type int

Right Arrow Size
The size of the right arrow, if present
Scripting name `rightArrowSize`
Data type int

Styles
Contains the component's styles
Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name
The name of this component.
Scripting name `name`
Data type String
Flags bindable

Visible
If disabled, the component will be hidden.
Scripting name `visible`
Data type boolean

Mouseover Text
The text that is displayed in the tooltip which pops up on mouseover of this component.
Scripting name `toolTipText`

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Data type String

Cursor — The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values

0	Default
1	Crosshair
2	Text
3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Data Quality — The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int
Flags bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.9.4 Pipe Segment

Description

Description missing.

Properties

Appearance

Center Fill — The center of the fill gradient

Scripting name `mainColor`
Data type Color
Flags bindable

Edge Fill — The edge of the fill gradient.

Scripting name `secondaryColor`
Data type Color
Flags bindable

Outline Color — The color of the outline border

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Scripting name `outlineColor`
Data type Color
Flags bindable

End 1 Top? Draw the border at end #1's top?

Scripting name `end1Top`
Data type boolean

End 1 Cap? Draw the border at end #1's cap?

Scripting name `end1Cap`
Data type boolean

End 1 Bottom? Draw the border at end #1's bottom?

Scripting name `end1Bottom`
Data type boolean

End 2 Top? Draw the border at end #2's top?

Scripting name `end2Top`
Data type boolean

End 2 Cap? Draw the border at end #2's cap?

Scripting name `end2Cap`
Data type boolean

End 2 Bottom? Draw the border at end #2's bottom?

Scripting name `end2Bottom`
Data type boolean

Styles Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
0 Default
1 Crosshair
2 Text

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3	Wait
12	Hand
13	Move
4	SW Resize
5	SE Resize
6	NW Resize
7	NE Resize
8	N Resize
9	S Resize
10	W Resize
11	E Resize

Data

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

9.9.5 Pipe Joint

Description

Description missing.

Properties

Appearance

Center Fill — The center of the fill gradient

Scripting name	`mainColor`
Data type	Color
Flags	bindable

Edge Fill — The edge of the fill gradient.

Scripting name	`secondaryColor`
Data type	Color
Flags	bindable

Outline Color — The color of the outline border

Scripting name	`outlineColor`
Data type	Color
Flags	bindable

Top? — Joint has an outlet at the top?

Scripting name	`top`
Data type	boolean

Right? — Joint has an outlet at the right?

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Scripting name `right`
Data type boolean

Bottom? Joint has an outlet at the bottom?

Scripting name `bottom`
Data type boolean

Left? Joint has an outlet at the left?

Scripting name `left`
Data type boolean

Styles Contains the component's styles

Scripting name `styles`
Data type Dataset
Flags bindable | expert

Common

Name The name of this component.

Scripting name `name`
Data type String
Flags bindable

Visible If disabled, the component will be hidden.

Scripting name `visible`
Data type boolean

Border The border surrounding this component. NOTE that the border is unaffected by rotation.

Scripting name `border`
Data type Border

Mouseover Text The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name `toolTipText`
Data type String

Cursor The mouse cursor to use when hovering over this component.

Scripting name `cursorCode`
Data type int
Values
0 Default
1 Crosshair
2 Text
3 Wait
12 Hand
13 Move
4 SW Resize
5 SE Resize
6 NW Resize
7 NE Resize
8 N Resize
9 S Resize
10 W Resize
11 E Resize

Data

Data Quality The data quality code for any tag bindings on this component.

Scripting name `dataQuality`
Data type int

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Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

mouse
mouseMotion
propertyChange

Scripting Functions

This component has no special scripting functions.

9.9.6 Sound Player

Description

The Sound Player component is an invisible component that facilitates audio playback in the client. Each Sound Player component has one sound clip associated with it, and will play that clip on demand. There is a built in triggering system, as well as facilities to loop the sound while the trigger is set. Note that the sound clip needs to be a *.wav file, and that the clip becomes embedded within the window that the sound player is on - clients do *not* need access to a shared *.wav file.

Properties

Behavior

Play Mode — The Play Mode determines whether the sound is played automatically on trigger or manually

Scripting name	`playMode`
Data type	int
Values	0 Manual 1 On Trigger

Loop Mode — The Loop Mode determines how many times the sound is played when triggered.

Scripting name	`loopMode`
Data type	int
Values	0 Play Once 1 Loop Forever 2 Loop N Times

Loop Count — If Loop Mode is "Loop N Times", this is the "N".

Scripting name	`loopCount`
Data type	int

Volume — The volume to use for playback (from 0.0 to 1.0).

Scripting name	`volume`
Data type	double

Mute — If true, the clip will be muted during playback.

Scripting name	`mute`
Data type	boolean

Common

Name — The name of this component.

Scripting name	`name`

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Data type	String
Flags	bindable

Mouseover Text — The text that is displayed in the tooltip which pops up on mouseover of this component.

Scripting name	`toolTipText`
Data type	String

Data

Trigger — The clip will be played when the trigger is true, if Play Mode is "ON_TRIGGER"

Scripting name	`trigger`
Data type	boolean
Flags	bindable

Sound Data — The clip that this component will play.

Scripting name	`soundData`
Data type	byte[]

Data Quality — The data quality code for any tag bindings on this component.

Scripting name	`dataQuality`
Data type	int
Flags	bindable | expert

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouse
- mouseMotion
- propertyChange

Scripting Functions

This component has no special scripting functions.

9.9.7 Timer

Description

The timer button is an invisible button that can be used to create repeated events in a window. This is often used for animations or repetitive scripts within a window. When running, the timer's *Value* property is incremented by the *Step By* value, until the value tis the *Bound*, at which point it repeats. It is often useful to bind other values to a timer's *Value* property.

For instance, if you set the timer's *Bound* property to 360, and bind an object's rotation to the *Value* property, the object will spin in a circle when the timer is running.

Or, suppose that you have images that make up frames of animation. Name your images: "`Frame0.png`", "`Frame1.png`", "`Frame2.png`". Set the timer's *Bound* to be 3, Then bind the *image path* of an image component to the following expression:

```
"Frame" + {Root Container.Timer.value} + ".png"
```

How fast the timer counts is up to the *Delay* property, which is the time between counts in milliseconds.

Want to run a script every time the timer counts? First, make sure you don't actually want to write a

project Timer Script, which will run on some interval whenever the application is running. In contrast, a script that works via a Timer *component* will only run while the window that contains the Timer is open, and the Timer is running. The way to do this is to attach an event script to the `actionPerformed` event.

Properties

Behavior

Delay (ms)
The delay in milliseconds between timer events.

Scripting name	`delay`
Data type	int
Flags	bindable

Initial Delay (ms)
The delay in milliseconds before the first event when running is set to true.

Scripting name	`initialDelay`
Data type	int
Flags	bindable

Running?
Determines whether or not the timer sends timer events.

Scripting name	`running`
Data type	boolean
Flags	bindable

Common

Name
The name of this component.

Scripting name	`name`
Data type	String

Data

Value
The current value of this timer, for use as a counter.At each iteration, this value will be set to ((value + step) MOD bound)

Scripting name	`value`
Data type	int
Flags	bindable

Step by
The amount added to the value each time this timer fires for use as a counter. (should be positive)

Scripting name	`step`
Data type	int

Bound
The value is always guaranteed to be less than this upper bound.

Scripting name	`max`
Data type	int

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- action
- propertyChange

Scripting Functions

This component has no special scripting functions.

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9.9.8 Signal Generator

Description

The signal generator is similar to the Timer component, but its value isn't simply a counter. Instead, you can choose from a variety of familiar 'signals'. You configure the frequency by setting the *Period* property, which is in milliseconds. You configure the resolution by setting the *Values/Period* property.

For example, if you choose a sine wave signal with a period of 2000 milliseconds and 10 values/period, your sine wave will have a frequency of 0.5 Hz, and its value will change 10 times every 2 seconds.

Properties

Behavior

Signal Type — The signal type (shape) of the signal value

Scripting name	`signalType`
Data type	int
Values	**0** Sine **2** Triangular **1** Ramp **3** Square **4** Random

Running? — Determines whether or not the signal is being generated.

Scripting name	`running`
Data type	boolean
Flags	bindable

Period — The period of the signal in milliseconds

Scripting name	`period`
Data type	int

Values/Period — The number of value changes per period

Scripting name	`valuesPerPeriod`
Data type	int

Common

Name — The name of this component.

Scripting name	`name`
Data type	String

Data

Value — The current value of this signal generator.

Scripting name	`value`
Data type	double
Flags	bindable

Upper Bound — The upper bound of the signal value.

Scripting name	`upper`
Data type	double

Lower Bound — The lower bound of the signal value.

Scripting name	`lower`
Data type	double

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Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

action
propertyChange

Scripting Functions

This component has no special scripting functions.

9.10 Reporting

9.10.1 ReportPanel

Description

This component is the heart of the Reporting Module. The customizer for this component is the Report Designer. See the Reporting section for more about creating dynamic reports.

Properties

Uncategorized

UI

UI

Scripting name	`UI`
Data type	PanelUI
Flags	bindable

UIClassID

UIClassID

Scripting name	`UIClassID`
Data type	String
Flags	bindable

accessibleContext

accessibleContext

Scripting name	`accessibleContext`
Data type	AccessibleContext
Flags	bindable

actionMap

actionMap

Scripting name	`actionMap`
Data type	ActionMap
Flags	bindable

alignmentX

alignmentX

Scripting name	`alignmentX`
Data type	float
Flags	bindable

alignmentY

alignmentY

Scripting name	`alignmentY`
Data type	float
Flags	bindable

ancestorListeners

ancestorListeners

Scripting name	`ancestorListeners`
Data type	AncestorListener[]
Flags	bindable

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appContext

appContext

Scripting name	`appContext`
Data type	VisionClientContext
Flags	bindable

autoscrolls

autoscrolls

Scripting name	`autoscrolls`
Data type	boolean
Flags	bindable

background

background

Scripting name	`background`
Data type	Color
Flags	bindable

backgroundSet

backgroundSet

Scripting name	`backgroundSet`
Data type	boolean
Flags	bindable

baselineResizeBehavior

baselineResizeBehavior

Scripting name	`baselineResizeBehavior`
Data type	BaselineResizeBehavior
Flags	bindable

border

border

Scripting name	`border`
Data type	Border
Flags	bindable

bounds

bounds

Scripting name	`bounds`
Data type	Rectangle
Flags	bindable

bytesPDF

bytesPDF

Scripting name	`bytesPDF`
Data type	byte[]
Flags	bindable

class

class

Scripting name	`class`
Data type	Class

colorModel

colorModel

Scripting name	`colorModel`
Data type	ColorModel
Flags	bindable

component

component

Scripting name	`component`
Data type	Component
Flags	bindable

componentCount

componentCount

Scripting name	`componentCount`
Data type	int
Flags	bindable

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componentListeners

componentListeners

Scripting name	`componentListeners`
Data type	ComponentListener[]
Flags	bindable

componentOrientation

componentOrientation

Scripting name	`componentOrientation`
Data type	ComponentOrientation
Flags	bindable

componentPopupMenu

componentPopupMenu

Scripting name	`componentPopupMenu`
Data type	JPopupMenu
Flags	bindable

components

components

Scripting name	`components`
Data type	Component[]
Flags	bindable

containerListeners

containerListeners

Scripting name	`containerListeners`
Data type	ContainerListener[]
Flags	bindable

cursor

cursor

Scripting name	`cursor`
Data type	Cursor
Flags	bindable

cursorCode

cursorCode

Scripting name	`cursorCode`
Data type	int
Flags	bindable

cursorSet

cursorSet

Scripting name	`cursorSet`
Data type	boolean
Flags	bindable

dataQuality

dataQuality

Scripting name	`dataQuality`
Data type	int
Flags	bindable

datasets

datasets

Scripting name	`datasets`
Data type	Map
Flags	bindable

datasource

datasource

Scripting name	`datasource`
Data type	DataSetDataSource
Flags	bindable

debugGraphicsOptions

debugGraphicsOptions

Scripting name	`debugGraphicsOptions`
Data type	int

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	Flags	bindable
displayable	displayable	
	Scripting name	`displayable`
	Data type	boolean
	Flags	bindable
doubleBuffered	doubleBuffered	
	Scripting name	`doubleBuffered`
	Data type	boolean
	Flags	bindable
dropTarget	dropTarget	
	Scripting name	`dropTarget`
	Data type	DropTarget
	Flags	bindable
dynamicProps	dynamicProps	
	Scripting name	`dynamicProps`
	Data type	TreeMap
	Flags	bindable
enabled	enabled	
	Scripting name	`enabled`
	Data type	boolean
	Flags	bindable
focusCycleRoot	focusCycleRoot	
	Scripting name	`focusCycleRoot`
	Data type	boolean
	Flags	bindable
focusCycleRootAncestor	focusCycleRootAncestor	
	Scripting name	`focusCycleRootAncestor`
	Data type	Container
	Flags	bindable
focusListeners	focusListeners	
	Scripting name	`focusListeners`
	Data type	FocusListener[]
	Flags	bindable
focusOwner	focusOwner	
	Scripting name	`focusOwner`
	Data type	boolean
	Flags	bindable
focusTraversable	focusTraversable	
	Scripting name	`focusTraversable`
	Data type	boolean
	Flags	bindable
focusTraversalKeys	focusTraversalKeys	
	Scripting name	`focusTraversalKeys`
	Data type	Set
	Flags	bindable
focusTraversalKeysEnabled	focusTraversalKeysEnabled	
	Scripting name	`focusTraversalKeysEnabled`

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	Data type	boolean
	Flags	bindable

focusTraversalPolicy

focusTraversalPolicy

Scripting name	`focusTraversalPolicy`
Data type	FocusTraversalPolicy
Flags	bindable

focusTraversalPolicyProvider

focusTraversalPolicyProvider

Scripting name	`focusTraversalPolicyProvider`
Data type	boolean
Flags	bindable

focusTraversalPolicySet

focusTraversalPolicySet

Scripting name	`focusTraversalPolicySet`
Data type	boolean
Flags	bindable

focusable

focusable

Scripting name	`focusable`
Data type	boolean
Flags	bindable

font

font

Scripting name	`font`
Data type	Font
Flags	bindable

fontSet

fontSet

Scripting name	`fontSet`
Data type	boolean
Flags	bindable

foreground

foreground

Scripting name	`foreground`
Data type	Color
Flags	bindable

foregroundSet

foregroundSet

Scripting name	`foregroundSet`
Data type	boolean
Flags	bindable

graphics

graphics

Scripting name	`graphics`
Data type	Graphics
Flags	bindable

graphicsConfiguration

graphicsConfiguration

Scripting name	`graphicsConfiguration`
Data type	GraphicsConfiguration
Flags	bindable

height

height

Scripting name	`height`
Data type	int
Flags	bindable

hierarchyBoundsListeners

hierarchyBoundsListeners

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	Scripting name	hierarchyBoundsListeners
	Data type	HierarchyBoundsListener[]
	Flags	bindable
hierarchyListeners	hierarchyListeners	
	Scripting name	hierarchyListeners
	Data type	HierarchyListener[]
	Flags	bindable
ignoreRepaint	ignoreRepaint	
	Scripting name	ignoreRepaint
	Data type	boolean
	Flags	bindable
inheritsPopupMenu	inheritsPopupMenu	
	Scripting name	inheritsPopupMenu
	Data type	boolean
	Flags	bindable
inputContext	inputContext	
	Scripting name	inputContext
	Data type	InputContext
	Flags	bindable
inputMap	inputMap	
	Scripting name	inputMap
	Data type	InputMap
	Flags	bindable
inputMethodListeners	inputMethodListeners	
	Scripting name	inputMethodListeners
	Data type	InputMethodListener[]
	Flags	bindable
inputMethodRequests	inputMethodRequests	
	Scripting name	inputMethodRequests
	Data type	InputMethodRequests
	Flags	bindable
inputVerifier	inputVerifier	
	Scripting name	inputVerifier
	Data type	InputVerifier
	Flags	bindable
insets	insets	
	Scripting name	insets
	Data type	Insets
	Flags	bindable
keyListeners	keyListeners	
	Scripting name	keyListeners
	Data type	KeyListener[]
	Flags	bindable
layout	layout	
	Scripting name	layout
	Data type	LayoutManager
	Flags	bindable

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lightweight

lightweight

Scripting name	`lightweight`
Data type	boolean
Flags	bindable

locale

locale

Scripting name	`locale`
Data type	Locale
Flags	bindable

location

location

Scripting name	`location`
Data type	Point
Flags	bindable

locationOnScreen

locationOnScreen

Scripting name	`locationOnScreen`
Data type	Point
Flags	bindable

managingFocus

managingFocus

Scripting name	`managingFocus`
Data type	boolean
Flags	bindable

maximumSize

maximumSize

Scripting name	`maximumSize`
Data type	Dimension
Flags	bindable

maximumSizeSet

maximumSizeSet

Scripting name	`maximumSizeSet`
Data type	boolean
Flags	bindable

minimumSize

minimumSize

Scripting name	`minimumSize`
Data type	Dimension
Flags	bindable

minimumSizeSet

minimumSizeSet

Scripting name	`minimumSizeSet`
Data type	boolean
Flags	bindable

mouseListeners

mouseListeners

Scripting name	`mouseListeners`
Data type	MouseListener[]
Flags	bindable

mouseMotionListeners

mouseMotionListeners

Scripting name	`mouseMotionListeners`
Data type	MouseMotionListener[]
Flags	bindable

mousePosition

mousePosition

Scripting name	`mousePosition`
Data type	Point

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	Flags	bindable

mouseWheelListeners

mouseWheelListeners

Scripting name	`mouseWheelListeners`
Data type	MouseWheelListener[]
Flags	bindable

name

name

Scripting name	`name`
Data type	String
Flags	bindable

nextFocusableComponent

nextFocusableComponent

Scripting name	`nextFocusableComponent`
Data type	Component
Flags	bindable

opaque

opaque

Scripting name	`opaque`
Data type	boolean
Flags	bindable

optimizedDrawingEnabled

optimizedDrawingEnabled

Scripting name	`optimizedDrawingEnabled`
Data type	boolean
Flags	bindable

paintingForPrint

paintingForPrint

Scripting name	`paintingForPrint`
Data type	boolean
Flags	bindable

paintingTile

paintingTile

Scripting name	`paintingTile`
Data type	boolean
Flags	bindable

parent

parent

Scripting name	`parent`
Data type	Container
Flags	bindable

peer

peer

Scripting name	`peer`
Data type	ComponentPeer
Flags	bindable

preferredSize

preferredSize

Scripting name	`preferredSize`
Data type	Dimension
Flags	bindable

preferredSizeSet

preferredSizeSet

Scripting name	`preferredSizeSet`
Data type	boolean
Flags	bindable

printingDPI

printingDPI

Scripting name	`printingDPI`

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Data type	int
Flags	bindable

printingMode

printingMode

Scripting name	`printingMode`
Data type	int
Flags	bindable

properties

properties

Scripting name	`properties`
Data type	DynamicPropertyDescriptor[]
Flags	bindable

propertiesLoading

propertiesLoading

Scripting name	`propertiesLoading`
Data type	int
Flags	bindable

propertyChangeListeners

propertyChangeListeners

Scripting name	`propertyChangeListeners`
Data type	PropertyChangeListener[]
Flags	bindable

registeredKeyStrokes

registeredKeyStrokes

Scripting name	`registeredKeyStrokes`
Data type	KeyStroke[]
Flags	bindable

reportLoading

reportLoading

Scripting name	`reportLoading`
Data type	boolean
Flags	bindable

requestFocusEnabled

requestFocusEnabled

Scripting name	`requestFocusEnabled`
Data type	boolean
Flags	bindable

rootPane

rootPane

Scripting name	`rootPane`
Data type	JRootPane
Flags	bindable

showing

showing

Scripting name	`showing`
Data type	boolean
Flags	bindable

size

size

Scripting name	`size`
Data type	Dimension
Flags	bindable

styles

styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable

suggestedFilename

suggestedFilename

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Scripting name	`suggestedFilename`
Data type	String
Flags	bindable

template

template

Scripting name	`template`
Data type	RMDocument
Flags	bindable

templateB64

templateB64

Scripting name	`templateB64`
Data type	String
Flags	bindable

toolTipText

toolTipText

Scripting name	`toolTipText`
Data type	String
Flags	bindable

toolkit

toolkit

Scripting name	`toolkit`
Data type	Toolkit
Flags	bindable

topLevelAncestor

topLevelAncestor

Scripting name	`topLevelAncestor`
Data type	Container
Flags	bindable

transferHandler

transferHandler

Scripting name	`transferHandler`
Data type	TransferHandler
Flags	bindable

treeLock

treeLock

Scripting name	`treeLock`
Data type	Object
Flags	bindable

valid

valid

Scripting name	`valid`
Data type	boolean
Flags	bindable

validateRoot

validateRoot

Scripting name	`validateRoot`
Data type	boolean
Flags	bindable

verifyInputWhenFocusTarget

verifyInputWhenFocusTarget

Scripting name	`verifyInputWhenFocusTarget`
Data type	boolean
Flags	bindable

vetoableChangeListeners

vetoableChangeListeners

Scripting name	`vetoableChangeListeners`
Data type	VetoableChangeListener[]
Flags	bindable

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visible

visible

Scripting name	`visible`
Data type	boolean
Flags	bindable

visibleRect

visibleRect

Scripting name	`visibleRect`
Data type	Rectangle
Flags	bindable

width

width

Scripting name	`width`
Data type	int
Flags	bindable

x

x

Scripting name	`x`
Data type	int
Flags	bindable

y

y

Scripting name	`y`
Data type	int
Flags	bindable

zoomFactor

zoomFactor

Scripting name	`zoomFactor`
Data type	float
Flags	bindable

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouseWheel
- mouse
- component
- mouseMotion
- container
- hierarchyBounds
- focus
- hierarchy
- inputMethod
- propertyChange
- ancestor
- key
- vetoableChange

Scripting Functions

This component has no special scripting functions.

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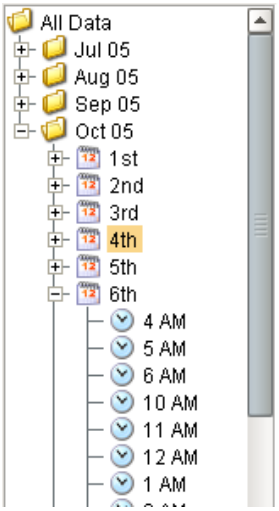
9.10.2 RowSelectorTree



Description

The row selector is a component that acts like a visual filter for datasets. It takes one dataset, chops it up into various ranges based on its configuration, and lets the user choose the splices. Then it creates a virtual dataset that only contains the rows that match the selected splices.

The most common way to splice the data is time. You could feed the row selector an input dataset that represents a large time range, and have it break it up by Month, Day, and then Shift, for example. Then you could power a report with the output dataset, and that would let the user dynamically create reports for any time range via an intuitive interface.

To configure the row selector, first you set up the appropriate bindings for its input dataset. Then you use its Customizer to alter the levels that it uses to break up the data. In the customizer, you add various filters that act upon columns in the input dataset, sorting them by various criteria. For example, you could choose a date column, and have it break that up by quarter. Then below that, you could have it use a discrete filter on a product code. This would let the user choose quarterly results for each product. Each level of filter you create in the customizer becomes a level in the selection hierarchy. Note that the output data is completely unchanged other than the fact that rows that don't match the current user selection aren't present.

This component is very handy for driving the Report Viewer, Table, and Classic Chart components, among others.

Properties

Uncategorized

UI	UI	
	Scripting name	`UI`
	Data type	ScrollPaneUI
	Flags	bindable
UIClassID	UIClassID	
	Scripting name	`UIClassID`
	Data type	String
	Flags	bindable

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accessibleContext

accessibleContext

Scripting name	`accessibleContext`
Data type	AccessibleContext
Flags	bindable

actionMap

actionMap

Scripting name	`actionMap`
Data type	ActionMap
Flags	bindable

alignmentX

alignmentX

Scripting name	`alignmentX`
Data type	float
Flags	bindable

alignmentY

alignmentY

Scripting name	`alignmentY`
Data type	float
Flags	bindable

allDataNodeText

allDataNodeText

Scripting name	`allDataNodeText`
Data type	String
Flags	bindable

ancestorListeners

ancestorListeners

Scripting name	`ancestorListeners`
Data type	AncestorListener[]
Flags	bindable

appContext

appContext

Scripting name	`appContext`
Data type	VisionClientContext
Flags	bindable

autoscrolls

autoscrolls

Scripting name	`autoscrolls`
Data type	boolean
Flags	bindable

background

background

Scripting name	`background`
Data type	Color
Flags	bindable

backgroundSet

backgroundSet

Scripting name	`backgroundSet`
Data type	boolean
Flags	bindable

baselineResizeBehavior

baselineResizeBehavior

Scripting name	`baselineResizeBehavior`
Data type	BaselineResizeBehavior
Flags	bindable

border

border

Scripting name	`border`
Data type	Border

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Flags	bindable

bounds

bounds

Scripting name	`bounds`
Data type	Rectangle
Flags	bindable

class

class

Scripting name	`class`
Data type	Class

colorModel

colorModel

Scripting name	`colorModel`
Data type	ColorModel
Flags	bindable

columnHeader

columnHeader

Scripting name	`columnHeader`
Data type	JView port
Flags	bindable

columnHeaderView

columnHeaderView

Scripting name	`columnHeaderView`
Data type	Component
Flags	bindable

component

component

Scripting name	`component`
Data type	Component
Flags	bindable

componentCount

componentCount

Scripting name	`componentCount`
Data type	int
Flags	bindable

componentListeners

componentListeners

Scripting name	`componentListeners`
Data type	ComponentListener[]
Flags	bindable

componentOrientation

componentOrientation

Scripting name	`componentOrientation`
Data type	ComponentOrientation
Flags	bindable

componentPopupMenu

componentPopupMenu

Scripting name	`componentPopupMenu`
Data type	JPopupMenu
Flags	bindable

components

components

Scripting name	`components`
Data type	Component[]
Flags	bindable

containerListeners

containerListeners

Scripting name	`containerListeners`
Data type	ContainerListener[]

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	Flags	bindable
cursor	cursor	
	Scripting name	`cursor`
	Data type	Cursor
	Flags	bindable
cursorCode	cursorCode	
	Scripting name	`cursorCode`
	Data type	int
	Flags	bindable
cursorSet	cursorSet	
	Scripting name	`cursorSet`
	Data type	boolean
	Flags	bindable
data	data	
	Scripting name	`data`
	Data type	Row FilteredDataSet
	Flags	bindable
dataIn	dataIn	
	Scripting name	`dataIn`
	Data type	Dataset
	Flags	bindable
dataOut	dataOut	
	Scripting name	`dataOut`
	Data type	Dataset
	Flags	bindable
dataQuality	dataQuality	
	Scripting name	`dataQuality`
	Data type	int
	Flags	bindable
debugGraphicsOptions	debugGraphicsOptions	
	Scripting name	`debugGraphicsOptions`
	Data type	int
	Flags	bindable
displayable	displayable	
	Scripting name	`displayable`
	Data type	boolean
	Flags	bindable
doubleBuffered	doubleBuffered	
	Scripting name	`doubleBuffered`
	Data type	boolean
	Flags	bindable
dropTarget	dropTarget	
	Scripting name	`dropTarget`
	Data type	DropTarget
	Flags	bindable
dynamicProps	dynamicProps	
	Scripting name	`dynamicProps`

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Data type	TreeMap
Flags	bindable

enabled

enabled

Scripting name	`enabled`
Data type	boolean
Flags	bindable

expandAllDataNode

expandAllDataNode

Scripting name	`expandAllDataNode`
Data type	boolean
Flags	bindable

filters

filters

Scripting name	`filters`
Data type	List
Flags	bindable

focusCycleRoot

focusCycleRoot

Scripting name	`focusCycleRoot`
Data type	boolean
Flags	bindable

focusCycleRootAncestor

focusCycleRootAncestor

Scripting name	`focusCycleRootAncestor`
Data type	Container
Flags	bindable

focusListeners

focusListeners

Scripting name	`focusListeners`
Data type	FocusListener[]
Flags	bindable

focusOwner

focusOwner

Scripting name	`focusOwner`
Data type	boolean
Flags	bindable

focusTraversable

focusTraversable

Scripting name	`focusTraversable`
Data type	boolean
Flags	bindable

focusTraversalKeys

focusTraversalKeys

Scripting name	`focusTraversalKeys`
Data type	Set
Flags	bindable

focusTraversalKeysEnabled

focusTraversalKeysEnabled

Scripting name	`focusTraversalKeysEnabled`
Data type	boolean
Flags	bindable

focusTraversalPolicy

focusTraversalPolicy

Scripting name	`focusTraversalPolicy`
Data type	FocusTraversalPolicy
Flags	bindable

focusTraversalPolicyProvider

focusTraversalPolicyProvider

	Scripting name	`focusTraversalPolicyProvider`
	Data type	boolean
	Flags	bindable

focusTraversalPolicySet

focusTraversalPolicySet

Scripting name	`focusTraversalPolicySet`
Data type	boolean
Flags	bindable

focusable

focusable

Scripting name	`focusable`
Data type	boolean
Flags	bindable

font

font

Scripting name	`font`
Data type	Font
Flags	bindable

fontSet

fontSet

Scripting name	`fontSet`
Data type	boolean
Flags	bindable

foreground

foreground

Scripting name	`foreground`
Data type	Color
Flags	bindable

foregroundSet

foregroundSet

Scripting name	`foregroundSet`
Data type	boolean
Flags	bindable

graphics

graphics

Scripting name	`graphics`
Data type	Graphics
Flags	bindable

graphicsConfiguration

graphicsConfiguration

Scripting name	`graphicsConfiguration`
Data type	GraphicsConfiguration
Flags	bindable

height

height

Scripting name	`height`
Data type	int
Flags	bindable

hierarchyBoundsListeners

hierarchyBoundsListeners

Scripting name	`hierarchyBoundsListeners`
Data type	HierarchyBoundsListener[]
Flags	bindable

hierarchyListeners

hierarchyListeners

Scripting name	`hierarchyListeners`
Data type	HierarchyListener[]
Flags	bindable

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horizontalScrollBar

horizontalScrollBar

Scripting name	`horizontalScrollBar`
Data type	JScrollBar
Flags	bindable

horizontalScrollBarPolicy

horizontalScrollBarPolicy

Scripting name	`horizontalScrollBarPolicy`
Data type	int
Flags	bindable

ignoreRepaint

ignoreRepaint

Scripting name	`ignoreRepaint`
Data type	boolean
Flags	bindable

inheritsPopupMenu

inheritsPopupMenu

Scripting name	`inheritsPopupMenu`
Data type	boolean
Flags	bindable

inputContext

inputContext

Scripting name	`inputContext`
Data type	InputContext
Flags	bindable

inputMap

inputMap

Scripting name	`inputMap`
Data type	InputMap
Flags	bindable

inputMethodListeners

inputMethodListeners

Scripting name	`inputMethodListeners`
Data type	InputMethodListener[]
Flags	bindable

inputMethodRequests

inputMethodRequests

Scripting name	`inputMethodRequests`
Data type	InputMethodRequests
Flags	bindable

inputVerifier

inputVerifier

Scripting name	`inputVerifier`
Data type	InputVerifier
Flags	bindable

insets

insets

Scripting name	`insets`
Data type	Insets
Flags	bindable

keyListeners

keyListeners

Scripting name	`keyListeners`
Data type	KeyListener[]
Flags	bindable

layout

layout

Scripting name	`layout`
Data type	LayoutManager

	Flags	bindable
lightweight	lightweight	
	Scripting name	`lightweight`
	Data type	boolean
	Flags	bindable
locale	locale	
	Scripting name	`locale`
	Data type	Locale
	Flags	bindable
location	location	
	Scripting name	`location`
	Data type	Point
	Flags	bindable
locationOnScreen	locationOnScreen	
	Scripting name	`locationOnScreen`
	Data type	Point
	Flags	bindable
managingFocus	managingFocus	
	Scripting name	`managingFocus`
	Data type	boolean
	Flags	bindable
maximumSize	maximumSize	
	Scripting name	`maximumSize`
	Data type	Dimension
	Flags	bindable
maximumSizeSet	maximumSizeSet	
	Scripting name	`maximumSizeSet`
	Data type	boolean
	Flags	bindable
minimumSize	minimumSize	
	Scripting name	`minimumSize`
	Data type	Dimension
	Flags	bindable
minimumSizeSet	minimumSizeSet	
	Scripting name	`minimumSizeSet`
	Data type	boolean
	Flags	bindable
mouseListeners	mouseListeners	
	Scripting name	`mouseListeners`
	Data type	MouseListener[]
	Flags	bindable
mouseMotionListeners	mouseMotionListeners	
	Scripting name	`mouseMotionListeners`
	Data type	MouseMotionListener[]
	Flags	bindable
mousePosition	mousePosition	
	Scripting name	`mousePosition`

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	Data type	Point
	Flags	bindable
mouseWheelListeners	mouseWheelListeners	
	Scripting name	mouseWheelListeners
	Data type	MouseWheelListener[]
	Flags	bindable
name	name	
	Scripting name	name
	Data type	String
	Flags	bindable
nextFocusableComponent	nextFocusableComponent	
	Scripting name	nextFocusableComponent
	Data type	Component
	Flags	bindable
opaque	opaque	
	Scripting name	opaque
	Data type	boolean
	Flags	bindable
optimizedDrawingEnabled	optimizedDrawingEnabled	
	Scripting name	optimizedDrawingEnabled
	Data type	boolean
	Flags	bindable
paintingForPrint	paintingForPrint	
	Scripting name	paintingForPrint
	Data type	boolean
	Flags	bindable
paintingTile	paintingTile	
	Scripting name	paintingTile
	Data type	boolean
	Flags	bindable
parent	parent	
	Scripting name	parent
	Data type	Container
	Flags	bindable
peer	peer	
	Scripting name	peer
	Data type	ComponentPeer
	Flags	bindable
preferredSize	preferredSize	
	Scripting name	preferredSize
	Data type	Dimension
	Flags	bindable
preferredSizeSet	preferredSizeSet	
	Scripting name	preferredSizeSet
	Data type	boolean
	Flags	bindable
properties	properties	

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Scripting name	properties
Data type	DynamicPropertyDescriptor[]
Flags	bindable

propertiesLoading

propertiesLoading

Scripting name	propertiesLoading
Data type	int
Flags	bindable

propertyChangeListeners

propertyChangeListeners

Scripting name	propertyChangeListeners
Data type	PropertyChangeListener[]
Flags	bindable

registeredKeyStrokes

registeredKeyStrokes

Scripting name	registeredKeyStrokes
Data type	KeyStroke[]
Flags	bindable

requestFocusEnabled

requestFocusEnabled

Scripting name	requestFocusEnabled
Data type	boolean
Flags	bindable

rootPane

rootPane

Scripting name	rootPane
Data type	JRootPane
Flags	bindable

rowHeader

rowHeader

Scripting name	rowHeader
Data type	JViewport
Flags	bindable

rowHeaderView

rowHeaderView

Scripting name	rowHeaderView
Data type	Component
Flags	bindable

selectionBackground

selectionBackground

Scripting name	selectionBackground
Data type	Color
Flags	bindable

showAllDataNode

showAllDataNode

Scripting name	showAllDataNode
Data type	boolean
Flags	bindable

showNodeSize

showNodeSize

Scripting name	showNodeSize
Data type	boolean
Flags	bindable

showRootHandles

showRootHandles

Scripting name	showRootHandles
Data type	boolean
Flags	bindable

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showing

showing

Scripting name `showing`
Data type boolean
Flags bindable

size

size

Scripting name `size`
Data type Dimension
Flags bindable

styles

styles

Scripting name `styles`
Data type Dataset
Flags bindable

toolTipText

toolTipText

Scripting name `toolTipText`
Data type String
Flags bindable

toolkit

toolkit

Scripting name `toolkit`
Data type Toolkit
Flags bindable

topLevelAncestor

topLevelAncestor

Scripting name `topLevelAncestor`
Data type Container
Flags bindable

transferHandler

transferHandler

Scripting name `transferHandler`
Data type TransferHandler
Flags bindable

treeLock

treeLock

Scripting name `treeLock`
Data type Object
Flags bindable

unknownIconPath

unknownIconPath

Scripting name `unknownIconPath`
Data type String
Flags bindable

unknownNodeText

unknownNodeText

Scripting name `unknownNodeText`
Data type String
Flags bindable

valid

valid

Scripting name `valid`
Data type boolean
Flags bindable

validateRoot

validateRoot

Scripting name `validateRoot`
Data type boolean

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	Flags	bindable
verifyInputWhenFocusTarget	verifyInputWhenFocusTarget	
	Scripting name	`verifyInputWhenFocusTarget`
	Data type	boolean
	Flags	bindable
verticalScrollBar	verticalScrollBar	
	Scripting name	`verticalScrollBar`
	Data type	JScrollBar
	Flags	bindable
verticalScrollBarPolicy	verticalScrollBarPolicy	
	Scripting name	`verticalScrollBarPolicy`
	Data type	int
	Flags	bindable
vetoableChangeListeners	vetoableChangeListeners	
	Scripting name	`vetoableChangeListeners`
	Data type	VetoableChangeListener[]
	Flags	bindable
viewport	viewport	
	Scripting name	`viewport`
	Data type	JView port
	Flags	bindable
viewportBorder	viewportBorder	
	Scripting name	`viewportBorder`
	Data type	Border
	Flags	bindable
viewportBorderBounds	viewportBorderBounds	
	Scripting name	`viewportBorderBounds`
	Data type	Rectangle
	Flags	bindable
viewportView	viewportView	
	Scripting name	`viewportView`
	Data type	Component
	Flags	bindable
visible	visible	
	Scripting name	`visible`
	Data type	boolean
	Flags	bindable
visibleRect	visibleRect	
	Scripting name	`visibleRect`
	Data type	Rectangle
	Flags	bindable
wheelScrollingEnabled	wheelScrollingEnabled	
	Scripting name	`wheelScrollingEnabled`
	Data type	boolean
	Flags	bindable
width	width	
	Scripting name	`width`

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	Data type	int
	Flags	bindable
x	x	
	Scripting name	x
	Data type	int
	Flags	bindable
y	y	
	Scripting name	y
	Data type	int
	Flags	bindable

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouseWheel
- mouse
- component
- mouseMotion
- container
- hierarchyBounds
- focus
- hierarchy
- inputMethod
- propertyChange
- ancestor
- key
- vetoableChange

Scripting Functions

This component has no special scripting functions.

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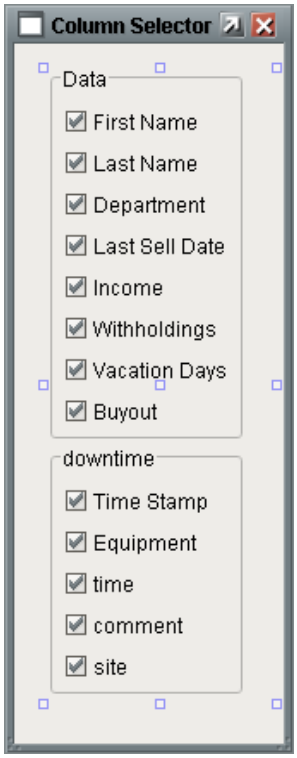
9.10.3 ColumnSelectorPanel



Description

The column selector component is conceptually similar to the Row Selector, except that instead of filtering rows, it filters columns from its output dataset. Each column from the input dataset is shown as a checkbox. As the user checks and un-checks columns, the output dataset has those columns added or removed. This is very handy for driving the Table and Classic Chart components.

Properties

Uncategorized

HGap — HGap

Scripting name	`HGap`
Data type	int
Flags	bindable

UI — UI

Scripting name	`UI`
Data type	ScrollPaneUI
Flags	bindable

UIClassID — UIClassID

Scripting name	`UIClassID`
Data type	String
Flags	bindable

VGap — VGap

Scripting name	`VGap`
Data type	int
Flags	bindable

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accessibleContext

accessibleContext

Scripting name	`accessibleContext`
Data type	AccessibleContext
Flags	bindable

actionMap

actionMap

Scripting name	`actionMap`
Data type	ActionMap
Flags	bindable

alignmentX

alignmentX

Scripting name	`alignmentX`
Data type	float
Flags	bindable

alignmentY

alignmentY

Scripting name	`alignmentY`
Data type	float
Flags	bindable

alphabetize

alphabetize

Scripting name	`alphabetize`
Data type	boolean
Flags	bindable

ancestorListeners

ancestorListeners

Scripting name	`ancestorListeners`
Data type	AncestorListener[]
Flags	bindable

appContext

appContext

Scripting name	`appContext`
Data type	VisionClientContext
Flags	bindable

autoscrolls

autoscrolls

Scripting name	`autoscrolls`
Data type	boolean
Flags	bindable

background

background

Scripting name	`background`
Data type	Color
Flags	bindable

backgroundSet

backgroundSet

Scripting name	`backgroundSet`
Data type	boolean
Flags	bindable

baselineResizeBehavior

baselineResizeBehavior

Scripting name	`baselineResizeBehavior`
Data type	BaselineResizeBehavior
Flags	bindable

border

border

Scripting name	`border`
Data type	Border

Flags	bindable

bounds

bounds

Scripting name	`bounds`
Data type	Rectangle
Flags	bindable

class

class

Scripting name	`class`
Data type	Class

colorModel

colorModel

Scripting name	`colorModel`
Data type	ColorModel
Flags	bindable

columnHeader

columnHeader

Scripting name	`columnHeader`
Data type	JView port
Flags	bindable

columnHeaderView

columnHeaderView

Scripting name	`columnHeaderView`
Data type	Component
Flags	bindable

component

component

Scripting name	`component`
Data type	Component
Flags	bindable

componentCount

componentCount

Scripting name	`componentCount`
Data type	int
Flags	bindable

componentListeners

componentListeners

Scripting name	`componentListeners`
Data type	ComponentListener[]
Flags	bindable

componentOrientation

componentOrientation

Scripting name	`componentOrientation`
Data type	ComponentOrientation
Flags	bindable

componentPopupMenu

componentPopupMenu

Scripting name	`componentPopupMenu`
Data type	JPopupMenu
Flags	bindable

components

components

Scripting name	`components`
Data type	Component[]
Flags	bindable

containerListeners

containerListeners

Scripting name	`containerListeners`
Data type	ContainerListener[]

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	Flags	bindable
cursor	cursor	
	Scripting name	`cursor`
	Data type	Cursor
	Flags	bindable
cursorCode	cursorCode	
	Scripting name	`cursorCode`
	Data type	int
	Flags	bindable
cursorSet	cursorSet	
	Scripting name	`cursorSet`
	Data type	boolean
	Flags	bindable
dataQuality	dataQuality	
	Scripting name	`dataQuality`
	Data type	int
	Flags	bindable
datasets	datasets	
	Scripting name	`datasets`
	Data type	List
	Flags	bindable
debugGraphicsOptions	debugGraphicsOptions	
	Scripting name	`debugGraphicsOptions`
	Data type	int
	Flags	bindable
displayable	displayable	
	Scripting name	`displayable`
	Data type	boolean
	Flags	bindable
doubleBuffered	doubleBuffered	
	Scripting name	`doubleBuffered`
	Data type	boolean
	Flags	bindable
dropTarget	dropTarget	
	Scripting name	`dropTarget`
	Data type	DropTarget
	Flags	bindable
dynamicProps	dynamicProps	
	Scripting name	`dynamicProps`
	Data type	TreeMap
	Flags	bindable
enabled	enabled	
	Scripting name	`enabled`
	Data type	boolean
	Flags	bindable
focusCycleRoot	focusCycleRoot	
	Scripting name	`focusCycleRoot`

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	Data type	boolean
	Flags	bindable

focusCycleRootAncestor

focusCycleRootAncestor

Scripting name	`focusCycleRootAncestor`
Data type	Container
Flags	bindable

focusListeners

focusListeners

Scripting name	`focusListeners`
Data type	FocusListener[]
Flags	bindable

focusOwner

focusOwner

Scripting name	`focusOwner`
Data type	boolean
Flags	bindable

focusTraversable

focusTraversable

Scripting name	`focusTraversable`
Data type	boolean
Flags	bindable

focusTraversalKeys

focusTraversalKeys

Scripting name	`focusTraversalKeys`
Data type	Set
Flags	bindable

focusTraversalKeysEnabled

focusTraversalKeysEnabled

Scripting name	`focusTraversalKeysEnabled`
Data type	boolean
Flags	bindable

focusTraversalPolicy

focusTraversalPolicy

Scripting name	`focusTraversalPolicy`
Data type	FocusTraversalPolicy
Flags	bindable

focusTraversalPolicyProvider

focusTraversalPolicyProvider

Scripting name	`focusTraversalPolicyProvider`
Data type	boolean
Flags	bindable

focusTraversalPolicySet

focusTraversalPolicySet

Scripting name	`focusTraversalPolicySet`
Data type	boolean
Flags	bindable

focusable

focusable

Scripting name	`focusable`
Data type	boolean
Flags	bindable

font

font

Scripting name	`font`
Data type	Font
Flags	bindable

fontSet

fontSet

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Scripting name	`fontSet`
Data type	boolean
Flags	bindable

foreground

foreground

Scripting name	`foreground`
Data type	Color
Flags	bindable

foregroundSet

foregroundSet

Scripting name	`foregroundSet`
Data type	boolean
Flags	bindable

graphics

graphics

Scripting name	`graphics`
Data type	Graphics
Flags	bindable

graphicsConfiguration

graphicsConfiguration

Scripting name	`graphicsConfiguration`
Data type	GraphicsConfiguration
Flags	bindable

grouping

grouping

Scripting name	`grouping`
Data type	boolean
Flags	bindable

height

height

Scripting name	`height`
Data type	int
Flags	bindable

hierarchyBoundsListeners

hierarchyBoundsListeners

Scripting name	`hierarchyBoundsListeners`
Data type	HierarchyBoundsListener[]
Flags	bindable

hierarchyListeners

hierarchyListeners

Scripting name	`hierarchyListeners`
Data type	HierarchyListener[]
Flags	bindable

horizontalScrollBar

horizontalScrollBar

Scripting name	`horizontalScrollBar`
Data type	JScrollBar
Flags	bindable

horizontalScrollBarPolicy

horizontalScrollBarPolicy

Scripting name	`horizontalScrollBarPolicy`
Data type	int
Flags	bindable

ignoreRepaint

ignoreRepaint

Scripting name	`ignoreRepaint`
Data type	boolean
Flags	bindable

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inheritsPopupMenu

inheritsPopupMenu

Scripting name	`inheritsPopupMenu`
Data type	boolean
Flags	bindable

inputContext

inputContext

Scripting name	`inputContext`
Data type	InputContext
Flags	bindable

inputMap

inputMap

Scripting name	`inputMap`
Data type	InputMap
Flags	bindable

inputMethodListeners

inputMethodListeners

Scripting name	`inputMethodListeners`
Data type	InputMethodListener[]
Flags	bindable

inputMethodRequests

inputMethodRequests

Scripting name	`inputMethodRequests`
Data type	InputMethodRequests
Flags	bindable

inputVerifier

inputVerifier

Scripting name	`inputVerifier`
Data type	InputVerifier
Flags	bindable

insets

insets

Scripting name	`insets`
Data type	Insets
Flags	bindable

keyListeners

keyListeners

Scripting name	`keyListeners`
Data type	KeyListener[]
Flags	bindable

layout

layout

Scripting name	`layout`
Data type	LayoutManager
Flags	bindable

lightweight

lightweight

Scripting name	`lightweight`
Data type	boolean
Flags	bindable

locale

locale

Scripting name	`locale`
Data type	Locale
Flags	bindable

location

location

Scripting name	`location`
Data type	Point

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	Flags	bindable
locationOnScreen	locationOnScreen	
	Scripting name	`locationOnScreen`
	Data type	Point
	Flags	bindable
managingFocus	managingFocus	
	Scripting name	`managingFocus`
	Data type	boolean
	Flags	bindable
maximumSize	maximumSize	
	Scripting name	`maximumSize`
	Data type	Dimension
	Flags	bindable
maximumSizeSet	maximumSizeSet	
	Scripting name	`maximumSizeSet`
	Data type	boolean
	Flags	bindable
minimumSize	minimumSize	
	Scripting name	`minimumSize`
	Data type	Dimension
	Flags	bindable
minimumSizeSet	minimumSizeSet	
	Scripting name	`minimumSizeSet`
	Data type	boolean
	Flags	bindable
mouseListeners	mouseListeners	
	Scripting name	`mouseListeners`
	Data type	MouseListener[]
	Flags	bindable
mouseMotionListeners	mouseMotionListeners	
	Scripting name	`mouseMotionListeners`
	Data type	MouseMotionListener[]
	Flags	bindable
mousePosition	mousePosition	
	Scripting name	`mousePosition`
	Data type	Point
	Flags	bindable
mouseWheelListeners	mouseWheelListeners	
	Scripting name	`mouseWheelListeners`
	Data type	MouseWheelListener[]
	Flags	bindable
name	name	
	Scripting name	`name`
	Data type	String
	Flags	bindable
nextFocusableComponent	nextFocusableComponent	
	Scripting name	`nextFocusableComponent`

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Data type	Component
Flags	bindable

normalizeWidths

normalizeWidths

Scripting name	`normalizeWidths`
Data type	boolean
Flags	bindable

opaque

opaque

Scripting name	`opaque`
Data type	boolean
Flags	bindable

optimizedDrawingEnabled

optimizedDrawingEnabled

Scripting name	`optimizedDrawingEnabled`
Data type	boolean
Flags	bindable

paintingForPrint

paintingForPrint

Scripting name	`paintingForPrint`
Data type	boolean
Flags	bindable

paintingTile

paintingTile

Scripting name	`paintingTile`
Data type	boolean
Flags	bindable

parent

parent

Scripting name	`parent`
Data type	Container
Flags	bindable

peer

peer

Scripting name	`peer`
Data type	ComponentPeer
Flags	bindable

preferredSize

preferredSize

Scripting name	`preferredSize`
Data type	Dimension
Flags	bindable

preferredSizeSet

preferredSizeSet

Scripting name	`preferredSizeSet`
Data type	boolean
Flags	bindable

properties

properties

Scripting name	`properties`
Data type	DynamicPropertyDescriptor[]
Flags	bindable

propertyChangeListeners

propertyChangeListeners

Scripting name	`propertyChangeListeners`
Data type	PropertyChangeListener[]
Flags	bindable

registeredKeyStrokes

registeredKeyStrokes

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Scripting name	registeredKeyStrokes
Data type	KeyStroke[]
Flags	bindable

requestFocusEnabled

requestFocusEnabled

Scripting name	requestFocusEnabled
Data type	boolean
Flags	bindable

rootPane

rootPane

Scripting name	rootPane
Data type	JRootPane
Flags	bindable

rowHeader

rowHeader

Scripting name	rowHeader
Data type	JViewport
Flags	bindable

rowHeaderView

rowHeaderView

Scripting name	rowHeaderView
Data type	Component
Flags	bindable

showing

showing

Scripting name	showing
Data type	boolean
Flags	bindable

size

size

Scripting name	size
Data type	Dimension
Flags	bindable

styles

styles

Scripting name	styles
Data type	Dataset
Flags	bindable

toolTipText

toolTipText

Scripting name	toolTipText
Data type	String
Flags	bindable

toolkit

toolkit

Scripting name	toolkit
Data type	Toolkit
Flags	bindable

topLevelAncestor

topLevelAncestor

Scripting name	topLevelAncestor
Data type	Container
Flags	bindable

transferHandler

transferHandler

Scripting name	transferHandler
Data type	TransferHandler
Flags	bindable

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treeLock — treeLock

Scripting name	`treeLock`
Data type	Object
Flags	bindable

valid — valid

Scripting name	`valid`
Data type	boolean
Flags	bindable

validateRoot — validateRoot

Scripting name	`validateRoot`
Data type	boolean
Flags	bindable

verifyInputWhenFocusTarget — verifyInputWhenFocusTarget

Scripting name	`verifyInputWhenFocusTarget`
Data type	boolean
Flags	bindable

verticalScrollBar — verticalScrollBar

Scripting name	`verticalScrollBar`
Data type	JScrollBar
Flags	bindable

verticalScrollBarPolicy — verticalScrollBarPolicy

Scripting name	`verticalScrollBarPolicy`
Data type	int
Flags	bindable

vetoableChangeListeners — vetoableChangeListeners

Scripting name	`vetoableChangeListeners`
Data type	VetoableChangeListener[]
Flags	bindable

viewport — viewport

Scripting name	`viewport`
Data type	JView port
Flags	bindable

viewportBorder — viewportBorder

Scripting name	`viewportBorder`
Data type	Border
Flags	bindable

viewportBorderBounds — viewportBorderBounds

Scripting name	`viewportBorderBounds`
Data type	Rectangle
Flags	bindable

viewportView — viewportView

Scripting name	`viewportView`
Data type	Component
Flags	bindable

visible — visible

Scripting name	`visible`
Data type	boolean

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	Flags	bindable
visibleRect	visibleRect	
	Scripting name	`visibleRect`
	Data type	Rectangle
	Flags	bindable
wheelScrollingEnabled	wheelScrollingEnabled	
	Scripting name	`wheelScrollingEnabled`
	Data type	boolean
	Flags	bindable
width	width	
	Scripting name	`width`
	Data type	int
	Flags	bindable
x	x	
	Scripting name	`x`
	Data type	int
	Flags	bindable
y	y	
	Scripting name	`y`
	Data type	int
	Flags	bindable

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouseWheel
- mouse
- component
- mouseMotion
- container
- hierarchyBounds
- focus
- hierarchy
- inputMethod
- propertyChange
- ancestor
- key
- vetoableChange

Scripting Functions

This component has no special scripting functions.

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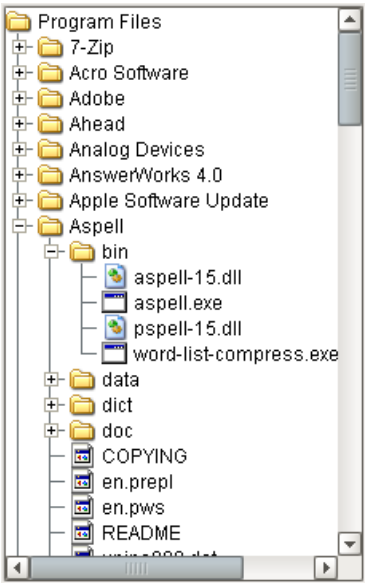
9.10.4 FileExplorer



Description

The File Explorer component displays a filesystem tree to the user. It can be rooted at any folder, even network folders. It can also filter the types of files that are displayed by their file extension (For example, "`pdf`"). The path to the file that the user selects in the tree is exposed in the bindable property *Selected Path*.

This component is typically used in conjuction with the PDF Viewer component, in order to create a PDF viewing window. This is very useful for viewing things like maintenance manuals from within your project. To use this component to drive a PDF Viewer component, follow these steps:

1. Bind the PDF Viewer's *Filename* property to the File Explorer's *Selected Path* property
2. Set the File Explorer's *File extension filter* to "`pdf`"
3. Set the File Explorer's *Root Directory* to a network folder that has your maintenance manuals in it. (Use a network folder so that all clients will be able to access the manuals).

Properties

Uncategorized

UI	UI	
	Scripting name	`UI`
	Data type	ScrollPaneUI
	Flags	bindable
UIClassID	UIClassID	
	Scripting name	`UIClassID`
	Data type	String
	Flags	bindable
accessibleContext	accessibleContext	
	Scripting name	`accessibleContext`
	Data type	AccessibleContext
	Flags	bindable

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actionMap

actionMap

Scripting name `actionMap`
Data type ActionMap
Flags bindable

alignmentX

alignmentX

Scripting name `alignmentX`
Data type float
Flags bindable

alignmentY

alignmentY

Scripting name `alignmentY`
Data type float
Flags bindable

ancestorListeners

ancestorListeners

Scripting name `ancestorListeners`
Data type AncestorListener[]
Flags bindable

appContext

appContext

Scripting name `appContext`
Data type VisionClientContext
Flags bindable

autoscrolls

autoscrolls

Scripting name `autoscrolls`
Data type boolean
Flags bindable

background

background

Scripting name `background`
Data type Color
Flags bindable

backgroundSet

backgroundSet

Scripting name `backgroundSet`
Data type boolean
Flags bindable

baselineResizeBehavior

baselineResizeBehavior

Scripting name `baselineResizeBehavior`
Data type BaselineResizeBehavior
Flags bindable

border

border

Scripting name `border`
Data type Border
Flags bindable

bounds

bounds

Scripting name `bounds`
Data type Rectangle
Flags bindable

class

class

Scripting name `class`
Data type Class

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colorModel

colorModel

Scripting name	`colorModel`
Data type	ColorModel
Flags	bindable

columnHeader

columnHeader

Scripting name	`columnHeader`
Data type	JView port
Flags	bindable

columnHeaderView

columnHeaderView

Scripting name	`columnHeaderView`
Data type	Component
Flags	bindable

component

component

Scripting name	`component`
Data type	Component
Flags	bindable

componentCount

componentCount

Scripting name	`componentCount`
Data type	int
Flags	bindable

componentEnabled

componentEnabled

Scripting name	`componentEnabled`
Data type	boolean
Flags	bindable

componentListeners

componentListeners

Scripting name	`componentListeners`
Data type	ComponentListener[]
Flags	bindable

componentOrientation

componentOrientation

Scripting name	`componentOrientation`
Data type	ComponentOrientation
Flags	bindable

componentPopupMenu

componentPopupMenu

Scripting name	`componentPopupMenu`
Data type	JPopupMenu
Flags	bindable

components

components

Scripting name	`components`
Data type	Component[]
Flags	bindable

containerListeners

containerListeners

Scripting name	`containerListeners`
Data type	ContainerListener[]
Flags	bindable

cursor

cursor

Scripting name	`cursor`
Data type	Cursor

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	Flags	bindable
cursorCode	cursorCode	
	Scripting name	`cursorCode`
	Data type	int
	Flags	bindable
cursorSet	cursorSet	
	Scripting name	`cursorSet`
	Data type	boolean
	Flags	bindable
dataQuality	dataQuality	
	Scripting name	`dataQuality`
	Data type	int
	Flags	bindable
debugGraphicsOptions	debugGraphicsOptions	
	Scripting name	`debugGraphicsOptions`
	Data type	int
	Flags	bindable
displayable	displayable	
	Scripting name	`displayable`
	Data type	boolean
	Flags	bindable
doubleBuffered	doubleBuffered	
	Scripting name	`doubleBuffered`
	Data type	boolean
	Flags	bindable
dropTarget	dropTarget	
	Scripting name	`dropTarget`
	Data type	DropTarget
	Flags	bindable
dynamicProps	dynamicProps	
	Scripting name	`dynamicProps`
	Data type	TreeMap
	Flags	bindable
enabled	enabled	
	Scripting name	`enabled`
	Data type	boolean
	Flags	bindable
fileFilter	fileFilter	
	Scripting name	`fileFilter`
	Data type	String
	Flags	bindable
focusCycleRoot	focusCycleRoot	
	Scripting name	`focusCycleRoot`
	Data type	boolean
	Flags	bindable
focusCycleRootAncestor	focusCycleRootAncestor	
	Scripting name	`focusCycleRootAncestor`

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	Data type	Container
	Flags	bindable
focusListeners	focusListeners	
	Scripting name	`focusListeners`
	Data type	FocusListener[]
	Flags	bindable
focusOwner	focusOwner	
	Scripting name	`focusOwner`
	Data type	boolean
	Flags	bindable
focusTraversable	focusTraversable	
	Scripting name	`focusTraversable`
	Data type	boolean
	Flags	bindable
focusTraversalKeys	focusTraversalKeys	
	Scripting name	`focusTraversalKeys`
	Data type	Set
	Flags	bindable
focusTraversalKeysEnabled	focusTraversalKeysEnabled	
	Scripting name	`focusTraversalKeysEnabled`
	Data type	boolean
	Flags	bindable
focusTraversalPolicy	focusTraversalPolicy	
	Scripting name	`focusTraversalPolicy`
	Data type	FocusTraversalPolicy
	Flags	bindable
focusTraversalPolicyProvider	focusTraversalPolicyProvider	
	Scripting name	`focusTraversalPolicyProvider`
	Data type	boolean
	Flags	bindable
focusTraversalPolicySet	focusTraversalPolicySet	
	Scripting name	`focusTraversalPolicySet`
	Data type	boolean
	Flags	bindable
focusable	focusable	
	Scripting name	`focusable`
	Data type	boolean
	Flags	bindable
font	font	
	Scripting name	`font`
	Data type	Font
	Flags	bindable
fontSet	fontSet	
	Scripting name	`fontSet`
	Data type	boolean
	Flags	bindable
foreground	foreground	

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Scripting name	foreground
Data type	Color
Flags	bindable

foregroundSet

foregroundSet

Scripting name	foregroundSet
Data type	boolean
Flags	bindable

graphics

graphics

Scripting name	graphics
Data type	Graphics
Flags	bindable

graphicsConfiguration

graphicsConfiguration

Scripting name	graphicsConfiguration
Data type	GraphicsConfiguration
Flags	bindable

height

height

Scripting name	height
Data type	int
Flags	bindable

hierarchyBoundsListeners

hierarchyBoundsListeners

Scripting name	hierarchyBoundsListeners
Data type	HierarchyBoundsListener[]
Flags	bindable

hierarchyListeners

hierarchyListeners

Scripting name	hierarchyListeners
Data type	HierarchyListener[]
Flags	bindable

horizontalScrollBar

horizontalScrollBar

Scripting name	horizontalScrollBar
Data type	JScrollBar
Flags	bindable

horizontalScrollBarPolicy

horizontalScrollBarPolicy

Scripting name	horizontalScrollBarPolicy
Data type	int
Flags	bindable

ignoreRepaint

ignoreRepaint

Scripting name	ignoreRepaint
Data type	boolean
Flags	bindable

inheritsPopupMenu

inheritsPopupMenu

Scripting name	inheritsPopupMenu
Data type	boolean
Flags	bindable

inputContext

inputContext

Scripting name	inputContext
Data type	InputContext
Flags	bindable

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inputMap

inputMap

Scripting name	`inputMap`
Data type	InputMap
Flags	bindable

inputMethodListeners

inputMethodListeners

Scripting name	`inputMethodListeners`
Data type	InputMethodListener[]
Flags	bindable

inputMethodRequests

inputMethodRequests

Scripting name	`inputMethodRequests`
Data type	InputMethodRequests
Flags	bindable

inputVerifier

inputVerifier

Scripting name	`inputVerifier`
Data type	InputVerifier
Flags	bindable

insets

insets

Scripting name	`insets`
Data type	Insets
Flags	bindable

keyListeners

keyListeners

Scripting name	`keyListeners`
Data type	KeyListener[]
Flags	bindable

layout

layout

Scripting name	`layout`
Data type	LayoutManager
Flags	bindable

lightweight

lightweight

Scripting name	`lightweight`
Data type	boolean
Flags	bindable

locale

locale

Scripting name	`locale`
Data type	Locale
Flags	bindable

location

location

Scripting name	`location`
Data type	Point
Flags	bindable

locationOnScreen

locationOnScreen

Scripting name	`locationOnScreen`
Data type	Point
Flags	bindable

managingFocus

managingFocus

Scripting name	`managingFocus`
Data type	boolean

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	Flags	bindable
maximumSize	maximumSize	
	Scripting name	`maximumSize`
	Data type	Dimension
	Flags	bindable
maximumSizeSet	maximumSizeSet	
	Scripting name	`maximumSizeSet`
	Data type	boolean
	Flags	bindable
minimumSize	minimumSize	
	Scripting name	`minimumSize`
	Data type	Dimension
	Flags	bindable
minimumSizeSet	minimumSizeSet	
	Scripting name	`minimumSizeSet`
	Data type	boolean
	Flags	bindable
mouseListeners	mouseListeners	
	Scripting name	`mouseListeners`
	Data type	MouseListener[]
	Flags	bindable
mouseMotionListeners	mouseMotionListeners	
	Scripting name	`mouseMotionListeners`
	Data type	MouseMotionListener[]
	Flags	bindable
mousePosition	mousePosition	
	Scripting name	`mousePosition`
	Data type	Point
	Flags	bindable
mouseWheelListeners	mouseWheelListeners	
	Scripting name	`mouseWheelListeners`
	Data type	MouseWheelListener[]
	Flags	bindable
name	name	
	Scripting name	`name`
	Data type	String
	Flags	bindable
nextFocusableComponent	nextFocusableComponent	
	Scripting name	`nextFocusableComponent`
	Data type	Component
	Flags	bindable
opaque	opaque	
	Scripting name	`opaque`
	Data type	boolean
	Flags	bindable
optimizedDrawingEnabled	optimizedDrawingEnabled	
	Scripting name	`optimizedDrawingEnabled`

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Data type	boolean
Flags	bindable

paintingForPrint

paintingForPrint

Scripting name	`paintingForPrint`
Data type	boolean
Flags	bindable

paintingTile

paintingTile

Scripting name	`paintingTile`
Data type	boolean
Flags	bindable

parent

parent

Scripting name	`parent`
Data type	Container
Flags	bindable

peer

peer

Scripting name	`peer`
Data type	ComponentPeer
Flags	bindable

preferredSize

preferredSize

Scripting name	`preferredSize`
Data type	Dimension
Flags	bindable

preferredSizeSet

preferredSizeSet

Scripting name	`preferredSizeSet`
Data type	boolean
Flags	bindable

properties

properties

Scripting name	`properties`
Data type	DynamicPropertyDescriptor[]
Flags	bindable

propertyChangeListeners

propertyChangeListeners

Scripting name	`propertyChangeListeners`
Data type	PropertyChangeListener[]
Flags	bindable

registeredKeyStrokes

registeredKeyStrokes

Scripting name	`registeredKeyStrokes`
Data type	KeyStroke[]
Flags	bindable

requestFocusEnabled

requestFocusEnabled

Scripting name	`requestFocusEnabled`
Data type	boolean
Flags	bindable

rootDir

rootDir

Scripting name	`rootDir`
Data type	String
Flags	bindable

rootPane

rootPane

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Scripting name	`rootPane`
Data type	JRootPane
Flags	bindable

rowHeader

rowHeader

Scripting name	`rowHeader`
Data type	JView port
Flags	bindable

rowHeaderView

rowHeaderView

Scripting name	`rowHeaderView`
Data type	Component
Flags	bindable

selectedPath

selectedPath

Scripting name	`selectedPath`
Data type	String
Flags	bindable

selectedPathIsFile

selectedPathIsFile

Scripting name	`selectedPathIsFile`
Data type	boolean
Flags	bindable

showing

showing

Scripting name	`showing`
Data type	boolean
Flags	bindable

size

size

Scripting name	`size`
Data type	Dimension
Flags	bindable

styles

styles

Scripting name	`styles`
Data type	Dataset
Flags	bindable

toolTipText

toolTipText

Scripting name	`toolTipText`
Data type	String
Flags	bindable

toolkit

toolkit

Scripting name	`toolkit`
Data type	Toolkit
Flags	bindable

topLevelAncestor

topLevelAncestor

Scripting name	`topLevelAncestor`
Data type	Container
Flags	bindable

transferHandler

transferHandler

Scripting name	`transferHandler`
Data type	TransferHandler
Flags	bindable

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treeLock — treeLock

Scripting name	`treeLock`
Data type	Object
Flags	bindable

valid — valid

Scripting name	`valid`
Data type	boolean
Flags	bindable

validateRoot — validateRoot

Scripting name	`validateRoot`
Data type	boolean
Flags	bindable

verifyInputWhenFocusTarget — verifyInputWhenFocusTarget

Scripting name	`verifyInputWhenFocusTarget`
Data type	boolean
Flags	bindable

verticalScrollBar — verticalScrollBar

Scripting name	`verticalScrollBar`
Data type	JScrollBar
Flags	bindable

verticalScrollBarPolicy — verticalScrollBarPolicy

Scripting name	`verticalScrollBarPolicy`
Data type	int
Flags	bindable

vetoableChangeListeners — vetoableChangeListeners

Scripting name	`vetoableChangeListeners`
Data type	VetoableChangeListener[]
Flags	bindable

viewport — viewport

Scripting name	`viewport`
Data type	JView port
Flags	bindable

viewportBorder — viewportBorder

Scripting name	`viewportBorder`
Data type	Border
Flags	bindable

viewportBorderBounds — viewportBorderBounds

Scripting name	`viewportBorderBounds`
Data type	Rectangle
Flags	bindable

viewportView — viewportView

Scripting name	`viewportView`
Data type	Component
Flags	bindable

visible — visible

Scripting name	`visible`
Data type	boolean

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	Flags	bindable
visibleRect	visibleRect	
	Scripting name	`visibleRect`
	Data type	Rectangle
	Flags	bindable
wheelScrollingEnabled	wheelScrollingEnabled	
	Scripting name	`wheelScrollingEnabled`
	Data type	boolean
	Flags	bindable
width	width	
	Scripting name	`width`
	Data type	int
	Flags	bindable
x	x	
	Scripting name	`x`
	Data type	int
	Flags	bindable
y	y	
	Scripting name	`y`
	Data type	int
	Flags	bindable

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouseWheel
- mouse
- component
- mouseMotion
- container
- hierarchyBounds
- focus
- hierarchy
- inputMethod
- propertyChange
- ancestor
- key
- vetoableChange

Scripting Functions

This component has no special scripting functions.

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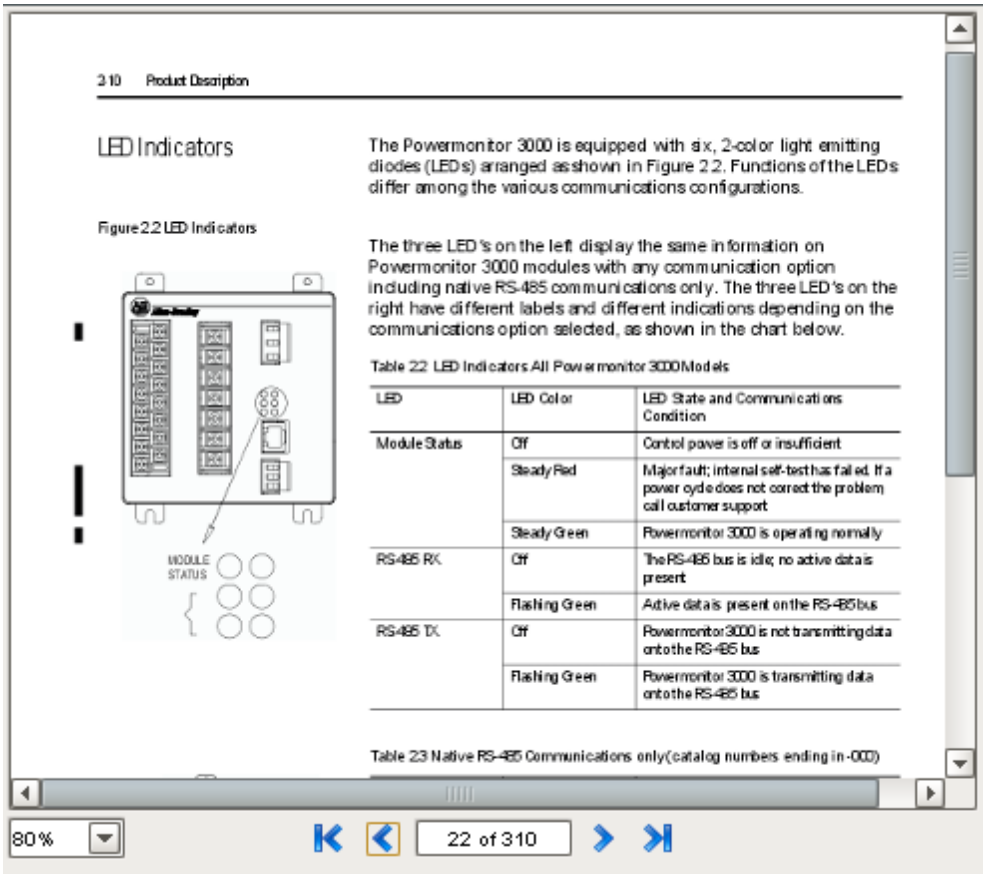
9.10.5 PDFViewer


2 10 Product Description
LED Indicators
The Powermonitor 3000 is equipped with six, 2-color light emitting diodes (LEDs) arranged as shown in Figure 2.2. Functions of the LEDs differ among the various communications configurations.
Figure 2.2 LED Indicators
The three LED's on the left display the same information on Powermonitor 3000 modules with any communication option including native RS-485 communications only. The three LED's on the right have different labels and different indications depending on the communications option selected, as shown in the chart below.
Table 2.2 LED Indicators All Powermonitor 3000 Models
LED
LED Color
LED State and Communications Condition
Module Status
Off
Control power is off or insufficient
Steady Red
Major fault; internal self-test has failed. If a power cycle does not correct the problem call customer support
Steady Green
Powermonitor 3000 is operating normally
RS-485 RX
Off
The RS-485 bus is idle; no active data is present
Flashing Green
Active data is present on the RS-485 bus
RS-485 TX
Off
Powermonitor 3000 is not transmitting data onto the RS-485 bus
Flashing Green
Powermonitor 3000 is transmitting data onto the RS-485 bus
Table 2.3 Native RS-485 Communications only (catalog numbers ending in -000)
MODULE STATUS
80%
22 of 310

The PDF Viewer showing a schematic in a maintenance manual

Description

The PDF Viewer component displays a PDF that exists as a file in some accessible filesystem, or as a URL. Note that this component is simply for *viewing existing* PDFs. To *create* dynamic reports, use the Report Viewer component.

This component is typically used in conjunction with the File Explorer component, in order to create a PDF viewing window. See the File Explorer's documentation for instructions on how to put these two components together.

Warning. This component is *not* as high-quality as Adobe Reader. This component can only be guaranteed to correctly display reports *generated* by the Report Viewer. In practice, it is able to view many PDFs, but it does have trouble with some, especially PDFs created by AutoCAD.

Properties

Uncategorized

UI	UI
	Scripting name `UI`
	Data type PanelUI
	Flags bindable

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UIClassID

UIClassID

Scripting name	`UIClassID`
Data type	String
Flags	bindable

accessibleContext

accessibleContext

Scripting name	`accessibleContext`
Data type	AccessibleContext
Flags	bindable

actionMap

actionMap

Scripting name	`actionMap`
Data type	ActionMap
Flags	bindable

alignmentX

alignmentX

Scripting name	`alignmentX`
Data type	float
Flags	bindable

alignmentY

alignmentY

Scripting name	`alignmentY`
Data type	float
Flags	bindable

ancestorListeners

ancestorListeners

Scripting name	`ancestorListeners`
Data type	AncestorListener[]
Flags	bindable

appContext

appContext

Scripting name	`appContext`
Data type	VisionClientContext
Flags	bindable

autoscrolls

autoscrolls

Scripting name	`autoscrolls`
Data type	boolean
Flags	bindable

background

background

Scripting name	`background`
Data type	Color
Flags	bindable

backgroundSet

backgroundSet

Scripting name	`backgroundSet`
Data type	boolean
Flags	bindable

baselineResizeBehavior

baselineResizeBehavior

Scripting name	`baselineResizeBehavior`
Data type	BaselineResizeBehavior
Flags	bindable

border

border

Scripting name	`border`
Data type	Border

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Flags	bindable

bounds

bounds

Scripting name	`bounds`
Data type	Rectangle
Flags	bindable

bytes

bytes

Scripting name	`bytes`
Data type	byte[]
Flags	bindable

class

class

Scripting name	`class`
Data type	Class

colorModel

colorModel

Scripting name	`colorModel`
Data type	ColorModel
Flags	bindable

component

component

Scripting name	`component`
Data type	Component
Flags	bindable

componentCount

componentCount

Scripting name	`componentCount`
Data type	int
Flags	bindable

componentListeners

componentListeners

Scripting name	`componentListeners`
Data type	ComponentListener[]
Flags	bindable

componentOrientation

componentOrientation

Scripting name	`componentOrientation`
Data type	ComponentOrientation
Flags	bindable

componentPopupMenu

componentPopupMenu

Scripting name	`componentPopupMenu`
Data type	JPopupMenu
Flags	bindable

components

components

Scripting name	`components`
Data type	Component[]
Flags	bindable

containerListeners

containerListeners

Scripting name	`containerListeners`
Data type	ContainerListener[]
Flags	bindable

cursor

cursor

Scripting name	`cursor`
Data type	Cursor

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	Flags	bindable
cursorCode	cursorCode	
	Scripting name	`cursorCode`
	Data type	int
	Flags	bindable
cursorSet	cursorSet	
	Scripting name	`cursorSet`
	Data type	boolean
	Flags	bindable
dataQuality	dataQuality	
	Scripting name	`dataQuality`
	Data type	int
	Flags	bindable
debugGraphicsOptions	debugGraphicsOptions	
	Scripting name	`debugGraphicsOptions`
	Data type	int
	Flags	bindable
displayable	displayable	
	Scripting name	`displayable`
	Data type	boolean
	Flags	bindable
doubleBuffered	doubleBuffered	
	Scripting name	`doubleBuffered`
	Data type	boolean
	Flags	bindable
dropTarget	dropTarget	
	Scripting name	`dropTarget`
	Data type	DropTarget
	Flags	bindable
dynamicProps	dynamicProps	
	Scripting name	`dynamicProps`
	Data type	TreeMap
	Flags	bindable
enabled	enabled	
	Scripting name	`enabled`
	Data type	boolean
	Flags	bindable
filename	filename	
	Scripting name	`filename`
	Data type	String
	Flags	bindable
focusCycleRoot	focusCycleRoot	
	Scripting name	`focusCycleRoot`
	Data type	boolean
	Flags	bindable
focusCycleRootAncestor	focusCycleRootAncestor	
	Scripting name	`focusCycleRootAncestor`

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	Data type	Container
	Flags	bindable
focusListeners	focusListeners	
	Scripting name	`focusListeners`
	Data type	FocusListener[]
	Flags	bindable
focusOwner	focusOwner	
	Scripting name	`focusOwner`
	Data type	boolean
	Flags	bindable
focusTraversable	focusTraversable	
	Scripting name	`focusTraversable`
	Data type	boolean
	Flags	bindable
focusTraversalKeys	focusTraversalKeys	
	Scripting name	`focusTraversalKeys`
	Data type	Set
	Flags	bindable
focusTraversalKeysEnabled	focusTraversalKeysEnabled	
	Scripting name	`focusTraversalKeysEnabled`
	Data type	boolean
	Flags	bindable
focusTraversalPolicy	focusTraversalPolicy	
	Scripting name	`focusTraversalPolicy`
	Data type	FocusTraversalPolicy
	Flags	bindable
focusTraversalPolicyProvider	focusTraversalPolicyProvider	
	Scripting name	`focusTraversalPolicyProvider`
	Data type	boolean
	Flags	bindable
focusTraversalPolicySet	focusTraversalPolicySet	
	Scripting name	`focusTraversalPolicySet`
	Data type	boolean
	Flags	bindable
focusable	focusable	
	Scripting name	`focusable`
	Data type	boolean
	Flags	bindable
font	font	
	Scripting name	`font`
	Data type	Font
	Flags	bindable
fontSet	fontSet	
	Scripting name	`fontSet`
	Data type	boolean
	Flags	bindable
foreground	foreground	

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Scripting name	foreground
Data type	Color
Flags	bindable

foregroundSet

foregroundSet

Scripting name	foregroundSet
Data type	boolean
Flags	bindable

graphics

graphics

Scripting name	graphics
Data type	Graphics
Flags	bindable

graphicsConfiguration

graphicsConfiguration

Scripting name	graphicsConfiguration
Data type	GraphicsConfiguration
Flags	bindable

height

height

Scripting name	height
Data type	int
Flags	bindable

hierarchyBoundsListeners

hierarchyBoundsListeners

Scripting name	hierarchyBoundsListeners
Data type	HierarchyBoundsListener[]
Flags	bindable

hierarchyListeners

hierarchyListeners

Scripting name	hierarchyListeners
Data type	HierarchyListener[]
Flags	bindable

ignoreRepaint

ignoreRepaint

Scripting name	ignoreRepaint
Data type	boolean
Flags	bindable

inheritsPopupMenu

inheritsPopupMenu

Scripting name	inheritsPopupMenu
Data type	boolean
Flags	bindable

inputContext

inputContext

Scripting name	inputContext
Data type	InputContext
Flags	bindable

inputMap

inputMap

Scripting name	inputMap
Data type	InputMap
Flags	bindable

inputMethodListeners

inputMethodListeners

Scripting name	inputMethodListeners
Data type	InputMethodListener[]
Flags	bindable

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inputMethodRequests

inputMethodRequests

Scripting name	`inputMethodRequests`
Data type	InputMethodRequests
Flags	bindable

inputVerifier

inputVerifier

Scripting name	`inputVerifier`
Data type	InputVerifier
Flags	bindable

insets

insets

Scripting name	`insets`
Data type	Insets
Flags	bindable

keyListeners

keyListeners

Scripting name	`keyListeners`
Data type	KeyListener[]
Flags	bindable

layout

layout

Scripting name	`layout`
Data type	LayoutManager
Flags	bindable

lightweight

lightweight

Scripting name	`lightweight`
Data type	boolean
Flags	bindable

locale

locale

Scripting name	`locale`
Data type	Locale
Flags	bindable

location

location

Scripting name	`location`
Data type	Point
Flags	bindable

locationOnScreen

locationOnScreen

Scripting name	`locationOnScreen`
Data type	Point
Flags	bindable

managingFocus

managingFocus

Scripting name	`managingFocus`
Data type	boolean
Flags	bindable

maximumSize

maximumSize

Scripting name	`maximumSize`
Data type	Dimension
Flags	bindable

maximumSizeSet

maximumSizeSet

Scripting name	`maximumSizeSet`
Data type	boolean

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	Flags	bindable

minimumSize

minimumSize

Scripting name	`minimumSize`
Data type	Dimension
Flags	bindable

minimumSizeSet

minimumSizeSet

Scripting name	`minimumSizeSet`
Data type	boolean
Flags	bindable

mouseListeners

mouseListeners

Scripting name	`mouseListeners`
Data type	MouseListener[]
Flags	bindable

mouseMotionListeners

mouseMotionListeners

Scripting name	`mouseMotionListeners`
Data type	MouseMotionListener[]
Flags	bindable

mousePosition

mousePosition

Scripting name	`mousePosition`
Data type	Point
Flags	bindable

mouseWheelListeners

mouseWheelListeners

Scripting name	`mouseWheelListeners`
Data type	MouseWheelListener[]
Flags	bindable

name

name

Scripting name	`name`
Data type	String
Flags	bindable

nextFocusableComponent

nextFocusableComponent

Scripting name	`nextFocusableComponent`
Data type	Component
Flags	bindable

opaque

opaque

Scripting name	`opaque`
Data type	boolean
Flags	bindable

optimizedDrawingEnabled

optimizedDrawingEnabled

Scripting name	`optimizedDrawingEnabled`
Data type	boolean
Flags	bindable

paintingForPrint

paintingForPrint

Scripting name	`paintingForPrint`
Data type	boolean
Flags	bindable

paintingTile

paintingTile

Scripting name	`paintingTile`

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Data type	boolean
Flags	bindable

parent

parent

Scripting name	`parent`
Data type	Container
Flags	bindable

peer

peer

Scripting name	`peer`
Data type	ComponentPeer
Flags	bindable

preferredSize

preferredSize

Scripting name	`preferredSize`
Data type	Dimension
Flags	bindable

preferredSizeSet

preferredSizeSet

Scripting name	`preferredSizeSet`
Data type	boolean
Flags	bindable

printingDPI

printingDPI

Scripting name	`printingDPI`
Data type	int
Flags	bindable

printingMode

printingMode

Scripting name	`printingMode`
Data type	int
Flags	bindable

properties

properties

Scripting name	`properties`
Data type	DynamicPropertyDescriptor[]
Flags	bindable

propertyChangeListeners

propertyChangeListeners

Scripting name	`propertyChangeListeners`
Data type	PropertyChangeListener[]
Flags	bindable

registeredKeyStrokes

registeredKeyStrokes

Scripting name	`registeredKeyStrokes`
Data type	KeyStroke[]
Flags	bindable

requestFocusEnabled

requestFocusEnabled

Scripting name	`requestFocusEnabled`
Data type	boolean
Flags	bindable

rootPane

rootPane

Scripting name	`rootPane`
Data type	JRootPane
Flags	bindable

showing

showing

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Scripting name	showing
Data type	boolean
Flags	bindable

size

size

Scripting name	size
Data type	Dimension
Flags	bindable

styles

styles

Scripting name	styles
Data type	Dataset
Flags	bindable

toolTipText

toolTipText

Scripting name	toolTipText
Data type	String
Flags	bindable

toolkit

toolkit

Scripting name	toolkit
Data type	Toolkit
Flags	bindable

topLevelAncestor

topLevelAncestor

Scripting name	topLevelAncestor
Data type	Container
Flags	bindable

transferHandler

transferHandler

Scripting name	transferHandler
Data type	TransferHandler
Flags	bindable

treeLock

treeLock

Scripting name	treeLock
Data type	Object
Flags	bindable

valid

valid

Scripting name	valid
Data type	boolean
Flags	bindable

validateRoot

validateRoot

Scripting name	validateRoot
Data type	boolean
Flags	bindable

verifyInputWhenFocusTarget

verifyInputWhenFocusTarget

Scripting name	verifyInputWhenFocusTarget
Data type	boolean
Flags	bindable

vetoableChangeListeners

vetoableChangeListeners

Scripting name	vetoableChangeListeners
Data type	VetoableChangeListener[]
Flags	bindable

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visible	visible	
	Scripting name	`visible`
	Data type	boolean
	Flags	bindable
visibleRect	visibleRect	
	Scripting name	`visibleRect`
	Data type	Rectangle
	Flags	bindable
width	width	
	Scripting name	`width`
	Data type	int
	Flags	bindable
x	x	
	Scripting name	`x`
	Data type	int
	Flags	bindable
y	y	
	Scripting name	`y`
	Data type	int
	Flags	bindable
zoomFactor	zoomFactor	
	Scripting name	`zoomFactor`
	Data type	float
	Flags	bindable

Scripting

Events

The following event sets are fired by this component. See Component Event Handlers to learn more.

- mouseWheel
- mouse
- component
- mouseMotion
- container
- hierarchyBounds
- focus
- hierarchy
- inputMethod
- propertyChange
- ancestor
- key
- vetoableChange

Scripting Functions

This component has no special scripting functions.

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Appendix B. Expression Functions

Part X

10 Appendix B. Expression Functions

10.1 Aggregates

10.1.1 groupConcat

groupConcat(dataset, column, separator**)**

Concatenates all of the values in the given `column` of the given `dataset` into a string, with each value separated by the string `separator`. Any null values in the column are ignored.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287
FWL_220	322	7.889

```
groupConcat({Root Container.Table.data}, 1, " / ")
```
... would return the string: `"380 / 120 / 125 / 322"`

```
groupConcat({Root Container.Table.data}, "ProductCode", ", ")
```
... would return the string: `"BAN_002, BAN_010, APL_000, FWL_220"`

10.1.2 max

max(dataset, column OR number, number...**)**

Finds and returns the maximum value in the given `column` of the given `dataset`, *or* the max value in a series of numbers specified as arguments. When looking up the max in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, zero is returned.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287
FWL_220	322	7.889

```
max({Root Container.Table.data}, 1)
```
... would return 380

You can also use this function to find the maximum in fixed series of numbers, specified as arguments, like this:

```
max(0, 10/2, 3.14)
```
... would return 5.

The following example is a great way to make sure a value never goes below zero:

```
max({SomeValue}, 0}
```

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10.1.3 maxDate

maxDate(dataset, columnIndex OR date, date...**)**

Finds and returns the maximum date in the given `column` of the given `dataset`, *or* the max value in a series of dates specified as arguments. When looking up the max date in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, `null` is returned.

For example, suppose you had a Table with this dataset in it:

AlertTime	Path	Severity
2010-01-08 7:28:04	Tanks/Tank5/TempHiAlert	4
2010-01-08 10:13:22	Tanks/Tank38/LoLevel	2
2010-01-08 13:02:56	Valves/Valve2/	2

You could use this expression to get the date and time for the most recent alert:

```
maxDate({Root Container.Table.data}, "AlertTime")
```

10.1.4 mean

mean(dataset, column OR number, number...**)**

Calculates the mean (a.k.a average) for the numbers in the given `column` of the given `dataset` *or* the mean of a series of numbers specified as arguments. When looking up the mean in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, zero is returned.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287
FWL_220	322	7.889

```
mean({Root Container.Table.data}, "Weight")
```

... would return 5.58675

```
mean(1,2,3)
```

... would return 2

10.1.5 median

median(dataset, column OR number, number...**)**

Calculates the median for the numbers in the given `column` of the given `dataset` *or* the median of a series of numbers specified as arguments. When looking up the median in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, zero is returned.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287

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FWL_220	322	7.889

```
median({Root Container.Table.data}, "Weight")
```
... would return 5.566

```
median(1,2,3,3,10)
```
... would return 3

10.1.6 min

min(dataset, column OR number, number...**)**

Finds and returns the minimum value in the given `column` of the given `dataset`, *or* the min value in a series of numbers specified as arguments. When looking up the min in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, zero is returned.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287
FWL_220	322	7.889

```
min({Root Container.Table.data}, 1)
```
... would return 120

You can also use this function to find the minimum in fixed series of numbers, specified as arguments, like this:

```
min(0, 10/2, 3.14)
```
... would return 0.

The following example is a great way to make sure a value never goes above 180:

```
min({SomeValue}, 180}
```

10.1.7 minDate

minDate(dataset, columnIndex OR date, date...**)**

Finds and returns the minimum date in the given `column` of the given `dataset`, *or* the min value in a series of dates specified as arguments. When looking up the min date in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, `null` is returned.

For example, suppose you had a Table with this dataset in it:

AlertTime	Path	Severity
2010-01-08 7:28:04	Tanks/Tank5/TempHiAlert	4
2010-01-08 10:13:22	Tanks/Tank38/LoLevel	2
2010-01-08 13:02:56	Valves/Valve2/	2

You could use this expression to get the date and time for the oldest alert:

```
minDate({Root Container.Table.data}, "AlertTime")
```

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10.1.8 stdDev

stdDev(dataset, column OR number, number...**)**

Calculates the standard deviation of the values in the given `column` of the given `dataset`, *or* the standard deviation for a series of numbers specified as arguments. When looking up the standard deviation in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, zero is returned.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287
FWL_220	322	7.889

```
stdDev({Root Container.Table.data}, "Weight")
```
... would return 4.00532

10.1.9 sum

sum(dataset, column OR number, number...**)**

Calculates the sum of the values in the given `column` of the given `dataset`, *or* the sum for a series of numbers specified as arguments. When looking up the sum in a dataset, the column may be specified as an index or as a column name. Any `null` values in the column are ignored. If there are no rows in the dataset, zero is returned.

For example, suppose you had a table with this dataset in it:

ProductCode	Quantity	Weight
BAN_002	380	3.243
BAN_010	120	9.928
APL_000	125	1.287
FWL_220	322	7.889

```
sum({Root Container.Table.data}, 1)
```
... would return 947

```
sum(1,2,3)
```
... would return 6

10.2 Colors

10.2.1 brighter

brighter(color**)**

Returns a color that is one shade brighter than the color given as an argument. Note that if you pass in a fully saturated color, like (255,0,0), it cannot be made brighter.

```
brighter(color(100,150,250))
```
... returns the color (142,214,255)

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10.2.2 color

color(red, green, blue, [alpha]**)**

Creates a color using the given red, green, and blue amounts, which are integers between 0-255. The optional alpha channel to the color controls transparency.

See also:
toColor

10.2.3 darker

darker(color**)**

Returns a color that is one shade darker than the color given as an argument.

```
darker(color(100,150,250))
```
... returns the color (70,105,175)

10.2.4 gradient

gradient(number, low, high, lowColor, highColor**)**

Calculates a percentage given the three numeric arguments `number`, `low`, and `high`. Uses this percentage to create a color that is a mix between the two colors.

```
gradient(0, 0, 100, toColor("red"), toColor("blue"))
```
...returns red.

```
gradient(100, 0, 100, toColor("red"), toColor("blue"))
```
...returns blue.

```
gradient(60, 0, 100, toColor("red"), toColor("blue"))
```
...returns a shade of purple.

```
gradient({Root Container.Tank.value}, 0, 100, color(255,0,0), color(0,0,255))
```
...will return a gradient from red to blue based on the level of a tank.

10.3 Date and Time

10.3.1 dateArithmetic

dateArithmetic(date, number, field**)**

Adds or subtracts some amount of time from a date, returning the resulting date. The field argument must be a string, and must be one of these options:

"second"	"hr"
"sec"	"day"
"minute"	"week"
"min"	"month"
"hour"	"year"

```
dateArithmetic(toDate("2010-01-04 8:00:00"), 5, "hour")
```
...returns the date '2010-01-04 13:00:00'

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```
dateArithmetic({Root Container.DatePicker.date}, -8, "days")
```
...returns a date eight days before the date in a Popup Calendar component.

10.3.2 dateDiff

dateDiff(date, date, field**)**

Calculates the difference between the two dates, returning the result as a floating point value in the units specified by `field`, which must be a string matching one of these values:

"second"	"hr"
"sec"	"day"
"minute"	"week"
"min"	"month"
"hour"	"year"

The return value will be a floating point value, meaning that parts of units are considered. The exception to this rule is for the months and years fields, which will always return an integral difference. If the second `date` argument is after the first, the return value will be positive, otherwise it will be negative.

```
dateDiff(toDate("2008-2-24 8:00:00"), toDate("2008-2-24 8:15:30"), "minute")
```
...returns 15.5

```
dateDiff(toDate("2008-2-24 8:00:00"), toDate("2008-3-12 9:28:00"), "month")
```
...returns 1.0

```
dateDiff(toDate("2008-2-24 8:00:00"), toDate("2008-3-12 9:28:00"), "day")
```
...returns 17.02

10.3.3 dateExtract

dateExtract(date, field**)**

Returns an integer value that is the value of the specified date field within the given date. The field must be a string, and must match one of these values:

"second"	"hr"
"sec"	"day"
"minute"	"week"
"min"	"month"
"hour"	"year"

Note: months are returned *zero-indexed*. That is, January is month 0, February is month 1, and so on. If this is inconvenient for you - just add one to the results.

```
dateExtract(toDate("2003-9-14 8:00:00"), "year")
```
...returns 2003

```
dateExtract(toDate("2009-1-15 8:00:00"), "month")
```
...returns 0

```
dateExtract(toDate("2008-1-24 8:00:00"), "month") + 1
```
...returns 1

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10.3.4 dateFormat

dateFormat(date, pattern**)**

Returns the given date as a string, formatted according to a pattern. The pattern is a format that is full of various placeholders that will display different parts of the date. These are case-sensitive! The most common placeholders are:

- **y** Year
- **M** Month
- **d** Day
- **E** Day of Week
- **a** am/pm marker
- **H** Hour of day (0-23)
- **h** Hour in am/pm (1-12)
- **m** Minute
- **s** Second
- **S** Millisecond
- **z** Time zone

These placeholders can be repeated for a different effect. For example, M will give you 1-12, MM will give you 01-12, MMM will give you Jan-Dec, MMMM will give you January-December.

```
dateFormat(toDate("2003-9-14 8:00:00"), "yyyy-MM-dd h a")
```
...returns the string "2003-09-14 8 am"

```
dateFormat(toDate("2003-9-14 8:00:00"), "MMM d, yyyy")
```
...returns the string "Sep 14, 2003"

10.3.5 now

now([pollRate]**)**

Returns the current time. The host computer's system clock is used, meaning that if this expression is being evaluated in a running client, the computer running the client's system clock is used. Note that this function is one of the few expression functions that will *poll*. If you do not specify a `pollRate`, it will default to 1,000ms. If you do not want this function to poll, use a poll rate of zero.

```
now()
```
...returns the current time, updates every second.

```
dateFormat(now(), "MMM d, h:mm a")
```
...returns a string representing the current time, formatted like "Feb 12, 9:54 AM"

10.3.6 timeBetween

timeBetween(date,date,date**)**

Checks to see if the given time is between the start and end times. The given times are expected as strings, and may include dates. Note: dates will be parsed according to the default system culture.

```
timeBetween(toDate("2003-9-14 12:00:00"), toDate("2003-9-14 8:00:00"), toDate("2003-9-14 18:00:
```
...returns true

```
timeBetween("2:00:00 pm", "9:00:00 am", "5:00:00 pm")
```
...returns true

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```
timeBetween("6/10/2006 2:00:00", "06/3/06 9:00:00", "2006-06-12 5:00:00")
```
...returns true (Note: This example also shows the variety of date formats accepted)

```
timeBetween(toDate("2003-9-14 20:00:00"), toDate("2003-9-14 18:00:00"), toDate("2003-9-15 2:00:
```
...returns true

10.4 Logic

10.4.1 binEnc

binEnc(boolean1, boolean2, ...**)**

This function, whose name stands for "binary encoder", takes a list of booleans, and treats them like the bits in a binary number. It returns an integer representing the decimal value of the number. The digits go from least significant to most significant.

This can be a very handy tool to convert bits into an integer code to drive the Component Styles feature.

```
binEnc(0,0,1,0)
```
...returns 4 (the value of 0100)

```
binEnc(true,0,1,1,0)
```
...returns 13 (the value of 01101)

10.4.2 binEnum

binEnum(boolean1, boolean2, ...**)**

This function, whose name stands for "binary enumeration", takes a list of booleans, and returns the index (starting at 1) of the first parameter that evaluates to true.

This can be a very handy tool to convert bits into an integer code to drive the Component Styles feature.

```
binEnum(0, 1, 0)
```
...returns 2

```
binEnum(0, false, 15, 0, 23)
```
...returns 3 (the index of the 15 - any non-zero number is "true")

10.4.3 coalesce

coalesce(value1, value2, ...**)**

This function, which accepts any number of arguments, evaluates each in order, and returns the first non-null argument. Typically, you would call this with two arguments - the first being something dynamic, the second being a static value to use as a guard in case the dynamic value is null. The function itself detects its return type based on the type of the last argument.

```
coalesce(null, "abc")
```
...would return "abc"

```
coalesce("xyz", "abc")
```

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...would return "xyz"

```
coalesce({Root Container.MyDataSet}["ColumnName"], 0)
```
...would return the value in the dataset if it isn't null, but 0 if it is null.

10.4.4 getBit

getBit(number, position)

This function returns the bit value (an integer, 0 or 1) in the `number` at position `position`, according to its binary representation. The least significant bit in a number is position 0.

```
getBit(0,0)
```
...would return 0

```
getBit(1,0)
```
...would return 1

```
getBit(8,3)
```
...would return 1

```
getBit(8,2)
```
...would return 0

10.4.5 if

if(condition, trueReturn, falseReturn)

This function evaluates the expression `condition`, and returns the value of `trueReturn` or `falseReturn` depending on the boolean value of `condition`.

```
if(1, "Yes", "No")
```
...would return "Yes"

```
if(0, "Yes", "No")
```
...would return "No"

```
if({Root Container.CheckBox.selected}, "Selected", "Not Selected")
```
...would return the a description of the state of the checkbox

10.4.6 isNull

isNull(value)

Tests to see whether or not the argument `value` is null or not. Note that you can also check for null by simply comparing the value to the null keyword. `isNull(x)` is the same as `x = null`.

```
if(isNull({Root Container.MyProperty}), 0, 1)
```
... returns 0 if the property is null, 1 otherwise. See also: coalesce.

10.4.7 lookup

lookup(dataset, lookupValue, noMatchValue, [lookupColumn], [resultColumn])

This looks for `lookupValue` in the `lookupColumn` of `dataset`. If it finds a match, it will return the value from the `resultColumn` on the same row as the match. If no match is found,

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noMatchValue is returned. Note: The type of the value returned will always be coerced to be the same type as the noMatchValue.

If lookupColumn is not specified, it defaults to 0. If resultColumn is not specified, it defaults to 1.

The examples are based of a table that has the following data in it:

PRODUCT	PRICE	CATEGORY
"Apples"	1.99	"Fruit"
"Carrots"	3.50	"Vegetable"
"Walnuts"	6.25	"Nut"

```
lookup({Root Container.Table.data}, "Carrots", -1.0)
```
... returns 3.50

```
lookup({Root Container.Table.data}, "Grapefruit", -1)
```
... returns -1, the noMatchValue

```
lookup({Root Container.Table.data}, "Walnuts", "Unknown", 0, "Category")
```
... returns "Nut"

```
lookup({Root Container.Table.data}, "Pecans", "Unknown", 0, 2)
```
... returns "Unknown", the noMatchValue

10.4.8 switch

switch(value, case1, ...caseN, return1, ...returnN, returnDefault**)**

This function acts like the switch statement in C-like programming languages. It takes the value argument and compares it to each of the case1 through caseN expressions. If value is equal to caseX, then switch returns valueX. If value is not equal to any of the case1..N, then returnDefault is returned.

```
switch(
15, // value
1,  // case 1
24, // case 2
15, // case 3
44, // return 1
45, // return 2
46, // return 3
-1) // default
```
...would return 46 because the value (15) matched case 3, so the third return (46) was returned.

```
switch(
35, // value
50,  // case 1
52, // case 2
200, // return 1
100, // return 2
-1) // default
```
...would return -1 because the value (35) didn't match case 1 or 2, so the returnDefault was used.

```
switch(
```

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```
1, // value
0, 1, 2,  // cases 1-3
"Off", // return 1
"Running", // return 2
"Fault", // return 3
forceQuality("!BAD STATE!",0)) // default
```

...would return "Running".

10.4.9 try

try(expression, failover)

This expression is used to swallow errors caused by other expressions. The first expression will be executed, and if it executes successfully, its value will be used. However, if there is an error evaluating it, the value of failover will be used, with a data quality of 310 (EXPRESSION_EVAL_ERROR).

```
try(toInteger("boom"), -1)
```

... returns -1 with a quality code of 310

10.5 Math

10.5.1 abs

abs(number)

Returns the absolute value of `number`.

```
abs(-4)
```

... returns 4

10.5.2 acos

acos(number)

Returns the arc cosine of `number`, which must be a number between -1 and 1. The results will be an angle expressed in radians in the range of `0.0` through *pi*.

```
acos(.38)
```

... returns 1.181

10.5.3 asin

asin(number)

Returns the arc sine of `number`, which must be a number between -1 and 1. The results will be an angle expressed in radians in the range of `-`*pi*`/2` through *pi*`/2`

```
asin(.38)
```

... returns 0.3898

10.5.4 atan

atan(number)

Returns the arc tangent of `number`, which must be a number. The results will be an angle expressed

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in radians in the range of `-pi/2` through `pi/2`

```
atan(.38)
```
... returns 0.3631

10.5.5 ceil

```
ceil(number)
```

Returns the smallest floating point value that is greater than or equal to the argument and is equal to a mathematical integer.

```
ceil(2.38)
```
... returns 3.0

10.5.6 cos

```
cos(number)
```

Returns the trigonometric cosine of `number`, which is interpreted as an angle expressed in radians. The results will be a floating point value.

```
cos(1.89)
```
... returns -0.31381

10.5.7 exp

```
exp(number)
```

Returns Euler's number *e* raised to the power of the argument `number`, or e^{number}

```
exp(5)
```
... returns 148.4

10.5.8 floor

```
floor(number)
```

Returns the largest floating point value that is less than or equal to the argument and is equal to a mathematical integer.

```
floor(2.72)
```
... returns 2.0

10.5.9 log

```
log(number)
```

Returns the natural logarithm (base *e*) of a `number`.

```
log(28)
```
... returns 3.332

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10.5.10 log10

```
log10(number)
```

--MISSING--

10.5.11 round

```
round(number, [decimals])
```

Rounds a floating point number. If the decimals argument is omitted, then the number is rounded to the nearest integer value, and the result will be a long (64-bit integer).

If a number of decimal places are specified, the result will be a double (64-bit floating point value), and the result will be rounded to the given number of decimal places.

```
round(3.829839, 2)
```

... returns 3.83

10.5.12 sin

```
sin(number)
```

Returns the trigonometric sine of `number`, which is interpreted as an angle expressed in radians. The results will be a floating point value.

```
sin(1.89)
```

... returns 0.9495

10.5.13 sqrt

```
sqrt(number)
```

Returns the square root of the argument `number`.

```
sqrt(64)
```

... returns 8.0

10.5.14 tan

```
tan(number)
```

Returns the trigonometric tangent of `number`, which is interpreted as an angle expressed in radians. The results will be a floating point value.

```
tan(1.89)
```

... returns -3.026

10.5.15 todegrees

```
todegrees(number)
```

Converts an angle measured in radians to an equivalent angle measured in degrees.

```
toDegrees(3.14)
```

... returns 179.9088

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10.5.16 toradians

```
toradians(number)
```

Converts an angle measured in degrees to an equivalent angle measured in radians.

```
toRadians(180)
```
... returns 3.141592653589793

10.6 Strings

10.6.1 concat

```
concat(string1, string2, ...)
```

Concatenates all of the strings passed in as arguments together. Rarely used, as the + operator does the same thing.

```
concat("The answer is: ", "42")
```
... returns "The answer is 42"

10.6.2 escapeSQL

```
escapeSQL(string)
```

Returns the given string with special SQL characters escaped. This is a fairly simplistic function - it just replaces single quotes with two single quotes, and backslashes with two backslashes. See system.db.runPrepUpdate for a much safer way to sanitize user input.

```
"SELECT * FROM mytable WHERE option = '" + escapeSQL("Jim's Settings") + "'"
```
... returns `SELECT * FROM mytable WHERE option='Jim''s Settings'`

```
"SELECT * FROM mytable WHERE option = '" + escapeSQL({Root Container.TextField.text}) + "'"
```
... returns a query with sanitized user input from a text field.

10.6.3 escapeXML

```
escapeXML(string)
```

Returns the given string after being escaped to be valid for inclusion in XML. This means replacing XML special characters with their XML entity equivalents.

```
escapeXML("Use Navigate > PB to get to the Pork&Beans section.")
```
... returns "Use `Navigate > PB to get to the Pork&Beans section.`"

10.6.4 indexOf

```
indexOf(string, substring)
```

Searches for the first occurrence of the `substring` inside of `string`. Returns the index of where `substring` was found, or -1 if it wasn't found.

```
indexOf("Hamburger", "urge")
```
...returns 4

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```
indexOf("Test", "")
```
...returns 0

```
indexOf("Disfunctional", "fun")
```
...returns 3

```
indexOf("Disfunctional", "marble")
```
...returns -1

```
indexOf("banana", "n")
```
...returns 2

10.6.5 lastIndexOf

lastIndexOf(string, substring**)**

Searches for the last occurrence of the `substring` inside of `string`. Returns the index of where `substring` was found, or -1 if it wasn't found.

```
indexOf("Hamburger", "urge")
```
...returns 4

```
indexOf("Test", "")
```
...returns 4

```
indexOf("Disfunctional", "fun")
```
...returns 3

```
indexOf("Disfunctional", "marble")
```
...returns -1

```
indexOf("banana", "n")
```
...returns 4

10.6.6 left

left(string, charCount**)**

Returns `count` characters from the left side of `string`, where `count` and `string` are the arguments to the function.

```
left("hello", 2)
```
...returns `"he"`

```
left("hello", 0)
```
...returns `""`

```
left("hello", 5)
```
...returns `"hello"`

10.6.7 len

len(value**)**

Returns the length of the argument, which may be a string or a dataset. If the argument is a string, it returns the number of characters in the string. If the argument is a dataset, it returns the number of

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rows in the dataset. Will return zero if the argument is null.

```
len("Hello World")
```
... returns 11

```
len({Root Container.Table.data})
```
... returns the number of rows in the table.

10.6.8 lower

lower(string**)**

Takes a string and returns a lower-case version of it.

```
lower("Hello World")
```
... returns "hello world"

10.6.9 numberFormat

numberFormat(number, pattern**)**

Returns a string version of the `number` argument, formatted as specified by the `pattern` string. This is commonly used to specify the number of decimal places to display, but can be used for more advanced formatting as well. The pattern string is a numeric format string, which may include any of these characters that instruct it how to format the number.

0	Specifies a required digit	**E**	Scientific notation
#	Specifies an optional digit	**;**	Used to separate positive and negative patterns
,	The grouping separator	**%**	Multiplies the value by 100 and shows as a percent
-	A minus sign	**'**	Used to quote special characters

This table shows some numbers, and the result of using various format strings to format them.

Number	Pattern	Result
5	0	5
5	0.0	5.0
5	00.0	05.0
123	#,##0	123
1024	#,##0	1,024
1337	#,##0.#	1,337
1337.42	#.##0.#	1,337.4
87.32	#,##0.0000	87.3200
-1234	#,##0	-1,234
-1234	#,##0;(#)	(1,234)
4096	0.###E0	4.096E3
.348	#.00%	34.80%
34.8	#0.00'%'	34.80%

Example:

```
numberFormat(34.8, "#0.00'%'")
```
... returns the string "34.80%"

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10.6.10 repeat

repeat(string, count**)**

Repeats the given string some number of times.

```
repeat("hello", 2)
```
...returns `"hellohello"`

```
repeat("hello", 0)
```
...returns `""`

10.6.11 replace

replace(string, string, string**)**

Finds all occurrences of a substring inside of a source string, and replaces them with the replacement string. The first argument is the source, the second is the search string, and the third is the replacement.

```
replace("XYZ", "Y", "and")
```
...returns `"XandZ"`

```
replace("bob and mary went to bob's house", "bob", "judith")
```
...returns `"judith and mary went to judith's house"`

10.6.12 right

right(string, charCount**)**

Returns `count` characters from the right side of `string`, where `count` and `string` are the arguments to the function.

```
right("hello", 2)
```
...returns `"lo"`

```
right("filename.pdf", 3)
```
...returns `"pdf"`

```
right("hello", 0)
```
...returns `""`

10.6.13 split

split(string, regex, [limit]**)**

This function takes the string `string` and splits it into a bunch of substrings. The substrings are return as a dataset with one column called "parts". The split occurs wherever the regular expression `regex` occurs. Don't be intimidated by the regular expression, this is normally just another string, like "," for comma separated lists.

The optional `limit` argument, if greater than zero, limits the number of times the regex pattern is applied to limit-1. Put another way, it limits the length of the resulting dataset to length limit. If limit is non-positive then the regex pattern will be applied as many times as possible and the returned dataset can have any length. If limit is zero (the default) then the pattern will be applied as many

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times as possible, the returned dataset can have any length, and trailing empty strings will be discarded.

```
split("hello,world", ",")
```
... returns

parts
"hello"
"world"

```
split("boo:and:foo", ":")
```
... returns

parts
"boo"
"and"
"foo"

```
split("boo:and:foo", ":", 2)
```
... returns

parts
"boo"
"and:foo"

10.6.14 stringFormat

stringFormat(format, args...**)**

Returns a formatted string using the specified format string and arguments.

See String.format(java.lang.String, java.lang.Object...) for more information.

```
formatString("Hello %s", "world")
```
... returns "Hello word"

```
formatString("%s, %s, %s", 1, 2, 3)
```
... returns "1, 2, 3"

10.6.15 substring

substring(string, startIndex, [endIndex]**)**

Substring will return the portion of the string from the `startIndex` to the `endIndex`, or end of the string if `endIndex` is not specified. All indexes start at 0, so in the string "Test", "s" is at index 2.

```
substring("unhappy", 2)
```
... returns `"happy"`

```
substring("hamburger", 4, 8)
```
... returns `"urge"`

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10.6.16 trim

trim(string**)**

Takes the argument string and trims of any leading and/or trailing whitespace, returning the result.

```
trim("Hello Dave  ")
```
... returns `"Hello Dave"`

```
trim(" Goodbye.")
```
... returns `"Goodbye."`

10.6.17 upper

upper(string**)**

Takes a string and returns an upper-case version of it.

```
upper("Hello World")
```
... returns "HELLO WORLD"

10.7 Type Casting

10.7.1 toBoolean

toBoolean(value, [failover]**)**

Tries to convert `value` to a boolean, according to these rules:
1. If `value` is a number, 0 is `false` and anything else is `true`.
2. If `value` is a string, then the strings (case insensitive) "on", "true", "t", "yes", "y" are all `true`. The strings (case insensitive) "off", "false", "f", "no", "n" are considered `false`. If the string represents a number, the first rule applies. All other strings fail type casting.
3. All other types fail type casting.

If type casting fails, an error is thrown, unless the `failover` argument is specified, in which case it will be used.

```
toBoolean(1)
```
... returns `true`.

```
toBoolean("abc", false)
```
... returns `false`

10.7.2 toBorder

toBorder(value, [failover]**)**

Takes a string and tries to convert it into a border. The string must be a semi-colon separated list of values. The first value is the name of the border. The other values depend on the type of border. The following table defines the border types and the arguments they accept.

Border Type	Options
`bevel`	**bevelType** Bevel Types: 0 = Raised

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	1 = Lowered 1010 = Double
button	*none*
etched	**etchType** Etch Types: 0 = Raised 1 = Lowered
etchedtitled	**title**; **style**; **fontJustification**; **fontPosition**; **fontColor**; **font** Styles: 0 = Etched / Lowered 1 = Etched / Raised 2 = Beveled / Lowered 3 = Beveled / Raised 4 = Develed / Double 5 = Standard
field	*none*
line	**color**; **thickness**
linetitled	**title**; **width**; **lineColor**; **fontJustification**; **fontPosition**; **fontColor**; **font**
matte	**color**; **topWidth**, **leftWidth**; **bottomWidth**; **rightWidth**
paneltitled	**title**; **style**; **mainColor**; bgColor, shadowSize, **fontJustification**; **fontPosition**; **fontColor**; **font** Styles: 0=Gradient / South-to-North 1=Gradient / West-to-East 2=Gradient / North-to-South 3=Gradient / East-to-West 4=Solid

Other Constants			
Font Justifications:	1 = Left 2 = Center 3 = Right 4 = Leading 5 = Trailing	Font Positions:	1 = Above Top 2 = Top 3 = Below Top 4 = Above Bottom 5 = Bottom 6 = Below Bottom

Examples:

```
toBorder("bevel;1010")
```

... returns

```
toBorder("matte;red;10;1;1;1")
```

... returns

```
toBorder("paneltitled;MyTitle")
```

... returns


```
toBorder("paneltitled;Options;1;lightgray;gray;0;;;(0,255,0)")
```

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... returns

10.7.3 toColor

toColor(value, [failover]**)**

This function tries to convert value to a color. It assumes that `value` is a string. If you have integers representing Red, Green, and Blue values see the color expression. The string `value` is converted to a color according to these rules:

1. If value is a name of a color as defined in the table below, the corresponding color will be returned. Note that color names are case insensitive.
2. If value is a hex color string (with or without a leading "#", the color equivalent of that hex string will be used. Examples: "#FF0000", "556B2F"
3. If value is a list of 3 or 4 integers, a color will be created that uses the first three integers as red, green, and blue values, and the optional fourth integer as an alpha channel value. All values should be between 0 and 255. The list is free-form, any non-digit characters may be used as delimiters between the digits. Examples: "(0,0,0)", "23-99-203", "[255,255,33,127]"

For example, all of these expressions return the color red:

```
toColor("red")
toColor("#FF0000")
toColor("255,0,0")
```

You can use the `failover` parameter to ensure that this expression returns something even if the input string may be bad:

```
toColor({UserOptions/CustomColor}, "black")
```

Named Colors		
AliceBlue	#F0F8FF	
AntiqueWhite	#FAEBD7	
Aqua	#00FFFF	
Aquamarine	#7FFFD4	
Azure	#F0FFFF	
Beige	#F5F5DC	
Bisque	#FFE4C4	
Black	#000000	
BlanchedAlmond	#FFEBCD	
Blue	#0000FF	
BlueViolet	#8A2BE2	
Brown	#A52A2A	
BurlyWood	#DEB887	
CadetBlue	#5F9EA0	
Chartreuse	#7FFF00	
Chocolate	#D2691E	
Clear	(transparent)	
Coral	#FF7F50	
CornflowerBlue	#6495ED	

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Cornsilk	#FFF8DC
Crimson	#DC143C
Cyan	#00FFFF
DarkBlue	#00008B
DarkCyan	#008B8B
DarkGoldenRod	#B8860B
DarkGray	#A9A9A9
DarkGreen	#006400
DarkKhaki	#BDB76B
DarkMagenta	#8B008B
DarkOliveGreen	#556B2F
Darkorange	#FF8C00
DarkOrchid	#9932CC
DarkRed	#8B0000
DarkSalmon	#E9967A
DarkSeaGreen	#8FBC8F
DarkSlateBlue	#483D8B
DarkSlateGray	#2F4F4F
DarkTurquoise	#00CED1
DarkViolet	#9400D3
DeepPink	#FF1493
DeepSkyBlue	#00BFFF
DimGray	#696969
DodgerBlue	#1E90FF
Feldspar	#D19275
FireBrick	#B22222
FloralWhite	#FFFAF0
ForestGreen	#228B22
Fuchsia	#FF00FF
Gainsboro	#DCDCDC
GhostWhite	#F8F8FF
Gold	#FFD700
GoldenRod	#DAA520
Gray	#808080
Green	#008000
GreenYellow	#ADFF2F
HoneyDew	#F0FFF0
HotPink	#FF69B4
IndianRed	#CD5C5C
Indigo	#4B0082
Ivory	#FFFFF0
Khaki	#F0E68C
Lavender	#E6E6FA
LavenderBlush	#FFF0F5
LawnGreen	#7CFC00
LemonChiffon	#FFFACD
LightBlue	#ADD8E6
LightCoral	#F08080
LightCyan	#E0FFFF
LightGoldenRodYellow	#FAFAD2

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LightGreen	#90EE90
LightGrey	#D3D3D3
LightPink	#FFB6C1
LightSalmon	#FFA07A
LightSeaGreen	#20B2AA
LightSkyBlue	#87CEFA
LightSlateBlue	#8470FF
LightSlateGray	#778899
LightSteelBlue	#B0C4DE
LightYellow	#FFFFE0
Lime	#00FF00
LimeGreen	#32CD32
Linen	#FAF0E6
Magenta	#FF00FF
Maroon	#800000
MediumAquaMarine	#66CDAA
MediumBlue	#0000CD
MediumOrchid	#BA55D3
MediumPurple	#9370D8
MediumSeaGreen	#3CB371
MediumSlateBlue	#7B68EE
MediumSpringGreen	#00FA9A
MediumTurquoise	#48D1CC
MediumVioletRed	#C71585
MidnightBlue	#191970
MintCream	#F5FFFA
MistyRose	#FFE4E1
Moccasin	#FFE4B5
NavajoWhite	#FFDEAD
Navy	#000080
OldLace	#FDF5E6
Olive	#808000
OliveDrab	#6B8E23
Orange	#FFA500
OrangeRed	#FF4500
Orchid	#DA70D6
PaleGoldenRod	#EEE8AA
PaleGreen	#98FB98
PaleTurquoise	#AFEEEE
PaleVioletRed	#D87093
PapayaWhip	#FFEFD5
PeachPuff	#FFDAB9
Peru	#CD853F
Pink	#FFC0CB
Plum	#DDA0DD
PowderBlue	#B0E0E6
Purple	#800080
Red	#FF0000
RosyBrown	#BC8F8F
RoyalBlue	#4169E1

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SaddleBrown	#8B4513
Salmon	#FA8072
SandyBrown	#F4A460
SeaGreen	#2E8B57
SeaShell	#FFF5EE
Sienna	#A0522D
Silver	#C0C0C0
SkyBlue	#87CEEB
SlateBlue	#6A5ACD
SlateGray	#708090
Snow	#FFFAFA
SpringGreen	#00FF7F
SteelBlue	#4682B4
Tan	#D2B48C
Teal	#008080
Thistle	#D8BFD8
Tomato	#FF6347
Transparent	#FFFFFF
Turquoise	#40E0D0
Violet	#EE82EE
VioletRed	#D02090
Wheat	#F5DEB3
White	#FFFFFF
WhiteSmoke	#F5F5F5
Yellow	#FFFF00
YellowGreen	#9ACD32

10.7.4 toDataSet

toDataSet(value, [failover]**)**

Tries to coerce `value` into a dataset. Not many things can be coerced into datasets. Namely, only DataSets and PyDataSets can be coerced into DataSets. This is useful for the runScript() expression, to convince the expression compiler to let you assign the return value of a scripting function to a DataSet property.

```
toDataSet(runScript("app.funcs.runSomeFunction()"))
```

... coerces the value returned by the a project scripting function into a dataset.

See also:
DataSets vs PyDataSets

10.7.5 toDate

toDate(value, [failover]**)**

Tries to coerce `value` into a Date. If `value` is a number or a string that represents a number, the number is treated as the number of milliseconds since the epoch, January 1, 1970, 00:00:00 GMT. If value is a string, it is parsed to see if it represents a date in one of these two formats: "yyyyMMdd.HHmmssSSSZ" or "yyyy-MM-dd HH:mm:ss". If not, type casting fails.
The failover value must be a number or string with the same restrictions.

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```
toDate("2007-04-12 16:28:22")
```
... returns April 12th, 2007, 4:28:22 PM

10.7.6 toDouble

toDouble(value, [failover]**)**

Tries to coerce `value` into a double (64-bit floating point value). If `value` is a number, the conversion is direct. If `value` is a string, it is parsed to see if it represents a double. If not, type casting fails.

```
toDouble("38.772")
```
... returns 38.772

```
toDouble({Root Container.TextField.text}, 0.0)
```
... returns the value in the text box as a double, or 0.0 if the value doesn't represent an number.

10.7.7 toFloat

toFloat(value, [failover]**)**

Tries to coerce `value` into a float (32-bit floating point vaule). If `value` is a number, the conversion is direct. If `value` is a string, it is parsed to see if it represents a float. If not, type casting fails.

```
toFloat("38.772")
```
... returns 38.772

```
toFloat({Root Container.TextField.text}, 0.0)
```
... returns the value in the text box as a float, or 0.0 if the value doesn't represent an number.

10.7.8 toFont

toFont(value, [failover]**)**

Coerces a string into a font. The string must be in the format:
`font(`*`fontName`*`, `*`fontType`*`, `*`fontSize`*`)`

fontName is the name of the font to use. Note that special care must be taken with fonts, because of the web-launched nature of the clients. You can only use font names that exist on the client machines. The following font names are known as *logical* fonts, meaning that they are guaranteed to exist on all systems, mapped to the most appropriate real, or *physical* font that exists on the host system:
- Serif
- SansSerif
- Monospaced
- Dialog
- DialogInput

fontType is a string, that should match one of these (case-insensitive):
- Plain
- Bold
- Italic
- BoldItalic

fontSize is an integer that represent the font's point size.

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```
toFont("font(Dialog,Bold,12)")
```
... returns the standard font used in most clients.

10.7.9 toInt

toInt(value, [failover]**)**

Tries to coerce value into an integer (32-bit integer). If value is a number, the conversion is direct (with possible loss of precision). If value is a string, it is parsed to see if it represents an integer. If not, type casting fails. Will round if appropriate.

```
toInt("38")
```
... returns 38

```
toInt("33.9")
```
... returns 34

```
toInt({Root Container.TextField.text}, -1)
```
... returns the value in the text box as an int, or -1 if the value doesn't represent an number.

10.7.10 toInteger

toInteger(value, [failover]**)**

Identical to the `toInt` expression function.

10.7.11 toLong

toLong(value, [failover]**)**

Tries to coerce value into a long (64-bit integer). If value is a number, the conversion is direct. If value is a string, it is parsed to see if it represents a long. If not, type casting fails. Will round if appropriate.

```
toLong("38")
```
... returns 38

```
toLong("33.9")
```
... returns 34

```
toLong({Root Container.TextField.text}, -1)
```
... returns the value in the text box as an long, or -1 if the value doesn't represent an number.

10.7.12 toStr

toStr(value, [failover]**)**

Identical to the `toString` expression function.

10.7.13 toString

toString(value, [failover]**)**

Represents the `value` as a string. Will succeed for any type of value.

```
toString(1/3.0)
```
... returns `"0.3333333333333333"`

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```
toString({Root Container.Table.data})
```
... returns something like: `"Dataset [150R x 3C]"`

10.8 Advanced

10.8.1 forceQuality

forceQuality(value, [qualityCode]**)**

Returns the given value, but overwrites the *quality* of that value. If the quality argument is omitted, the quality will be GOOD (192). This is a way to have expressions opt-out of the quality overlay system. You can also force a specific quality code here by including the quality argument.

```
forceQuality({Tanks/Tank15})
```
... returns the value of the Tank15 tag, but always with a good quality code.

```
forceQuality({Tanks/Tank15}, 410)
```
... returns the value of the Tank15 tag, but always with a TAG_DISABLED quality.

See also:
Quality Overlays

10.8.2 runScript

runScript(scriptFunction, [pollRate]**)**

Runs a single line of Python code as an expression. If a poll rate is specified, the function will be run repeatedly at the poll rate. This is a very powerful way for you to add extensions to the expression language.

For example, one could write a project script module function called `app.weather.getTempAt(zip)` that queried a web service for the current temperature at a given zipcode, and then bind the value of a label to the return value of that function.

You could implement `app.weather.getTempAt(zip)` with this *Python script*:

```
# This function would query Yahoo Weather for the temperature at
# the given zipcode and find the temperature using a regular expression
def getTempAt(zipCode):
    import system
    import re #Regular Expression library

    response = system.net.httpGet("http://xml.weather.yahoo.com/forecastrss?p=" + str(zipCode))

    # NOTE - if you've never seen regular expressions before, don't worry, they look
    # confusing even to people who use them frequently.
    pattern = re.compile('.*?<yweather:condition (.*?)/>', re.DOTALL)
    match = pattern.match(response)
    if match:
        subText = match.group(1)
        temp = re.compile('.*?temp="(.*?)"').match(subText).group(1)
        return int(temp)
    else:
        system.gui.errorBox("Yahoo weather service changed")
        return -1
```

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And then you could use this *expression* to bind a property value to the weather:

```
runScript("app.weather.getTempAt('95818')", 15000)
```

... This would bind a property to the temperature in sunny Sacramento, CA, and would refresh itself every 15 seconds.

See also:
About Python

10.8.3 sortDataset

sortDataset(dataset, keyColumn, [ascending]**)**

Returns a new dataset based on the rows in the given dataset. Sort order is natural if the Class of `keyColumn` implements `java.lang.Comparable`, otherwise sorting is done by the `toString()` value.

```
sortDataset(dataset, 0, true)
```

... returns a Dataset sorted ascending on column 0.

```
sortDataset(dataset, "Column 1", false)
```

... returns a Dataset sorted descending on the column named "Column 1".

10.8.4 tag

tag(tagPath**)**

Returns the value of the tag at the path specified. Normally, you'd use the expression language's built-in bound-value syntax to use a tag value in an expression. What makes this function useful is that the path itself can be the result of an expression, meaning it can be dynamic.

```
tag("Tanks/Tank5")
```

... returns Tank5's value.

```
tag("Tanks/Tank" + {Root Container.TankNum})
```

... returns the value for the tank represented by the dynamic property TankNum on the Root Container.

See also:
Indirect Tag Binding

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Appendix C. Scripting Functions

Part XI

11 Appendix C. Scripting Functions

11.1 About

The Ignition scripting API, which is available under the module name "system", is full of functions that are useful when designing projects in Ignition. From running database queries, manipulating components, to

Some of these functions only work in the Gateway scope, and other only work in the Client scope, while the rest will work in any scope.

"*I'm upgrading from FactoryPMI - will my calls to fpmi.* still work?*"
Yes. Ignition's scripting API is backwards compatible. You'll probably want to gradually move your "`fpmi`" references to "`system`" but you don't need to.

See also:
Gateway vs Client Scripts

11.2 system.alarm

11.2.1 system.alarm.acknowledge

Description

Acknowledges any number of alarms, specified by their event ids. The event id is generated for an alarm when it becomes active, and is used to identify a particular event from other events for the same source. The alarms will be acknowledged by the logged in user making the call. Additionally, acknowledgement notes may be included and will be stored along with the acknowledgement.

Syntax

```
system.alarm.acknowledge(alarmIds, notes)
```

Parameters

String[] `alarmIds` - List of alarm event ids (uuids) to acknowledge.
String `notes` - Notes that will be stored on the acknowledged alarm events.

Returns

nothing

Scope

Client

Examples

This example shows the basic syntax for acknowledging an alarm.

```
system.alarm.acknowledge(['c27c06d8-698f-4814-af89-3c22944f58c5'],'Saw this alarm, did somethin
```

This code snippet could be used as a `mouseReleased` event handler on a Table component whose `data` was the return value of the `system.alarm.queryAlarmStatus` function. It would present a right-click menu to acknowledge the currently selected alarms (for more than one, the table must be set to allow multiple selection). This example does not ask for an ack message, and therefore might fail if the alarms we're attempting to acknowledge require notes. Also, note that the system will ignore any alarms that have already been acknowledged.

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```
if event.button==3:
   rows = event.source.selectedRows
   data = event.source.data
   if len(rows)>0:
      uuids = [str(data.getValueAt(r,'EventId')) for r in rows]
      def ack(event, uuids=uuids):
         import system
         system.alarm.acknowledge(uuids, None)
      menu = system.gui.createPopupMenu({'Acknowledge':ack})
      menu.show(event)
```

See also:
Event Types / Mouse Events
system.alarm.queryStatus
system.gui.createPopupMenu

11.2.2 system.alarm.getShelvedPaths

Description

Returns a list of the current shelved alarm paths. A "path" may be either a source path, or a display path.

Syntax

```
system.alarm.getShelvedPaths()
```

Parameters
none

Returns
List

Scope
All

Examples

```
paths = system.alarm.getShelvedPaths()
for p in paths:
   print "Path: %s, Shelved by: %s, expires: %s, is expired? %s" % (p.getPath(), p.getUser(), p
```

11.2.3 system.alarm.queryJournal

Description

Queries the specified journal for historical alarm events. The result is a list of alarm events, which can be queried for individual properties. The result object also has a `getDataset()` function that can be used to convert the query results into a normal dataset, with the columns: `EventId, Source, DisplayPath, EventTime, EventState, Priority, IsSystemEvent`

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

system.alarm.**queryJournal(**startDate, endDate, journalName, priority, state, path, source, displaypath, all_properties, any_properties, defined, includeData, includeSystem, isSystem**)**

Parameters

Date `startDate` - The start of the time range to query. Defaults to 8 hours previous to now if omitted. Time range is inclusive.

Date `endDate` - The end of the time range to query. Defaults to "now" if omitted.

String `journalName`

String[] `priority` - A list of possible priorities to match. Priorities can be specified by name or number, with the values: Diagnostic(0), Low(1), Medium(2), High(3), Critical(4).

String[] `state` - A list of the event state types to match. Valid values are "ClearUnacked", "ClearAcked", "ActiveUnacked", and "ActiveAcked".

String[] `path`

String[] `source` - A list of possible source paths to search at. The wildcard "*" may be used.

String[] `displaypath` - A list of display paths to search at. Display paths are separated by "/", and if a path ends in "/*", everything below that path will be searched as well.

Object[][] `all_properties` - A set of property conditions, all of which must be met for the condition to pass. This parameter is a list of tuples, in the form ("propName", "condition", value). Valid condition values: "=","!=","<","<=",">",">=". Only the first two conditions may be used for string values.

Object[][] `any_properties` - A set of property conditions, any of which will cause the overall the condition to pass. This parameter is a list of tuples, in the form ("propName", "condition", value). Valid condition values: "=","!=","<","<=",">",">=". Only the first two conditions may be used for string values.

String[] `defined` - A list of string property names, all of which must be present on an event for it to pass.

Boolean `includeData` - Whether or not event data should be included in the return. If this parameter is false, and if there are no conditions specified on associated data, the properties table will not be queried.

Boolean `includeSystem` - Specifies whether system events are included in the return.

Boolean `isSystem` - Specifies whether the returned event must or must not be a system event.

Returns

List

Scope

All

Examples

This example shows the basic syntax for querying from the journal in a button's actionPerformed event, with a date range selector ("Range"), storing the results back to a table called "Table":

```
table = event.source.parent.getComponent("Table")
range = event.source.parent.getComponent("Range")

results = system.alarm.queryJournal(journalName="Journal", startDate=range.startDate, endDate=r
table.data = results.getDataset()
```

This example extends the previous to only include non-acknowledged events of High or Critical severity, who have associated data called "Department", set to "maintenance". It also excludes system events (shelving notifications, etc):

```
table = event.source.parent.getComponent("Table")
```

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```
range = event.source.parent.getComponent("Range")

results = system.alarm.queryJournal(journalName="Journal", startDate=range.startDate, endDate=r
    state=['ActiveUnacked', 'ClearUnacked'], all_properties=[("Department","=","maintenance")],
table.data = results.getDataset()
```

11.2.4 system.alarm.queryStatus

Description

Queries the current state of alarms. The result is a list of alarm events, which can be queried for individual properties. The result object also has a `getDataset()` function that can be used to convert the query results into a normal dataset, with the columns: `EventId, Source, DisplayPath, EventTime, State, Priority`

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

system.alarm.**queryStatus(**priority, state, path, source, displaypath, all_properties, any_properties, defined**)**

Parameters

String[] `priority` - A list of possible priorities to match. Priorities can be specified by name or number, with the values: Diagnostic(0), Low(1), Medium(2), High(3), Critical(4).

String[] `state` - A list of states to allow. Valid values: "ClearUnacked", "ClearAcked", "ActiveUnacked", "ActiveAcked".

String[] `path`

String[] `source` - A list of possible source paths to search at. The wildcard "*" may be used.

String[] `displaypath` - A list of display paths to search at. Display paths are separated by "/", and if a path ends in "/*", everything below that path will be searched as well.

Object[][] `all_properties` - A set of property conditions, all of which must be met for the condition to pass. This parameter is a list of tuples, in the form ("propName", "condition", value). Valid condition values: "=","!=","<","<=",">",">=". Only the first two conditions may be used for string values.

Object[][] `any_properties` - A set of property conditions, any of which will cause the overall the condition to pass. This parameter is a list of tuples, in the form ("propName", "condition", value). Valid condition values: "=","!=","<","<=",">",">=". Only the first two conditions may be used for string values.

String[] `defined` - A list of string property names, all of which must be present on an event for it to pass.

Returns

List

Scope

All

Examples

This example queries the state of all tags named "HiAlarm", and puts the results in a table named "Table" (this assumes it's being run from a button on the same screen):

```
table = event.source.parent.getComponent("Table")

results = system.alarm.queryStatus(source=["*HiAlarm*"])
```

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```
table.data = results.getDataset()
```

11.2.5 system.alarm.shelve

Description

This function shelves the specified alarms for the specified amount of time. The paths may be either source paths, or display paths. The time can be specified in minutes (timeoutMinutes) or seconds (timeoutSeconds). If an alarm is already shelved, this will overwrite the remaining time. To unshelve alarms, this function may be used with a time of "0".

Syntax

```
system.alarm.shelve(path, timeoutSeconds, timeoutMinutes)
```

Parameters

String[] `path` - A list of possible source paths to search at. If a path ends in "/*", the results will include anything below that path.

Integer `timeoutSeconds` - The amount of time to shelve the matching alarms for, specified in seconds. 0 indicates that matching alarm events should now be allowed to pass.

Integer `timeoutMinutes` - The amount of time to shelve the matching alarms for, specified in minutes. 0 indicates that matching alarm events should now be allowed to pass.

Returns

nothing

Scope

All

Examples

This example assumes that data has been loaded into a table ("Table") from system.alarm.queryStatus, and it shelves the selected alarms for 5 minutes. It also assumes that it is being executed from a button's actionPerformed event.

```
table = event.source.parent.getComponent('Table')
rows = table.selectedRows
data = table.data
if len(rows)>0:
   sourcePaths = [str(data.getValueAt(r,'Source')) for r in rows]
   system.alarm.shelve(path=sourcePaths,timeoutMinutes=5)
```

See also:
system.alarm.queryStatus

11.3 system.alert

11.3.1 system.alert.acknowledgeAlert

Description

Acknowledges an alert, as specified by a `system`, `path`, and `stateName`. When run in a Client script, the currently logged-in user will be recorded as having acknowledged the alert. When run in a Gateway script, you must provide a username that will be recorded with the acknowledgement, since no user actually acknowledged the alert.

Syntax

system.alert.**acknowledgeAlert(**system, path, stateName**)**

Parameters

String `system` - The originating system for the alert being acknowledged.
String `path` - The path to the alert being acknowledged.
String `stateName` - The alert state name to acknowledge.

Returns

nothing

Scope

Client

system.alert.**acknowledgeAlert(**system, path, stateName, user**)**

Parameters

String `system` - The originating system for the alert being acknowledged.
String `path` - The path to the alert being acknowledged.
String `stateName` - The alert state name to acknowledge.
String `user` - A username to use for who acknowledged this alert. Only available in the Gateway-scoped version of this function.

Returns

nothing

Scope

Gateway

Examples

This example shows the basic syntax for acknowledging an alert.

```
system.alert.acknowledgeAlert("SQLTags.default", "[default]Alm_ESTOP", "ALM_STOP")
```

This code snippet could be used as a `mouseReleased` event handler on a Table component whose `data` was the return value of the `system.alert.queryAlertStatus` function. It would present a right-click menu to acknowledge the currently selected alert.

```
row = event.source.selectedRow
if row != -1:
   data = event.source.data
   alertSys = data.getValueAt(row,"System")
   alertPath = data.getValueAt(row,"Path")
   alertState = data.getValueAt(row,"State Name")
   def ack(event, aSys=alertSys, aPath=alertPath, aState=alertState):
      import system
      system.alert.acknowledgeAlert(aSys,aPath,aState)

   menu = system.gui.createPopupMenu({"Acknowledge":ack})
   menu.show(event)
```

See also:
Event Types / Mouse Events
system.alert.queryAlertStatus
system.gui.createPopupMenu

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11.3.2 system.alert.queryAlertHistory

Description

This function queries one of the configured Alert Storage profiles for alert history. The filter arguments help to narrow down the results to alerts that match various criteria, most commonly a range of dates. You can use `*` to match any number of characters and `?` to match a single character in the filter string arguments.

The results of this function are a dataset with the following columns:
System - The system that issued the alert.
Path - The path to the alert item
Display Path - The custom display path (if any) for the alert. Will be the Path if no Display Path is configured.
State Name - The state name for the alert.
Severity - The severity, as a string.
Severity Code - The severity as an integer. 0-4, low-high.
Active - A boolean indicating whether this alert state is still active.
Active Timestamp - The time at which this alert went active.
Active Value - The value that triggered this alert to go active.
Cleared - A boolean indicating whether this alert has cleared.
Cleared Timestamp - The time at which this alert cleared. May be null.
Cleared Value - The value that cleared the alert.
Acked - A boolean indicating whether or not this alert was been acknowledged.
Ack Timestamp - The time that the alert was acknowledged. May be null.
Ack user - The user who acknowledged the alert.
Notes - The notes field for the alert
Flags - A bitmask representing the current alert state. 0x01= Active, 0x02=Cleared, 0x04=Acknowledged. So if the alert is active and acknowledged, but not cleared, this will be 0x01 | 0x04 = 5;

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

```
system.alert.queryAlertHistory(storageProfile, startDate, endDate, system, path, stateName, minSeverity, maxSeverity, activeAndUnacked, activeAndAcked, clearAndUnacked, clearAndAcked, sortOrder, displayPath)
```

Parameters

String `storageProfile` - The name of the alert storage profile to query.
Date `startDate` - Earliest alert to return. Defaults to 8 hours earlier than current time if omitted.
Date `endDate` - Latest alert to return. Defaults to current time if omitted.
String `system` - Filter string to restrict results based on the alert system.
String `path` - Filter string to restrict results based on the alert path.
String `stateName` - Filter string to restrict results based on the alert state name.
Integer `minSeverity` - Minimum severity to return. Defaults to 0 (Low).
Integer `maxSeverity` - Maximum severity to return. Defaults to 4 (High).
Boolean `activeAndUnacked` - Whether or not to return alerts that are currently active and unacknowledged. Default is true.
Boolean `activeAndAcked` - Whether or not to return alerts that are currently active and have been acknowledged. Default is true.

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Boolean `clearAndUnacked` - Whether or not to return alerts that are cleared and unacknowledged. Default is true.
Boolean `clearAndAcked` - Whether or not to return alerts that are cleared and have been acknowledged. Default is true.
String `sortOrder` - The sort order in which to return matching alerts. Either "asc" or "desc", referring to the alert's active timestamp. Default is "desc".
String `displayPath` - Filter string to restrict results based on the alert's display path.

Returns

Dataset - A dataset containing the historical alert events from the given storage profile that matched the filter and date range arguments.

Scope

All

Examples

This code would query an alert storage profile called "DBHistory", looking for the number of unacknowledged alerts in the last 36 hours, displaying the number to the user in a popup message.

```
from java.util import Date
from java.util import Calendar

cal = Calendar.getInstance()

end = cal.getTime()
cal.add(Calendar.HOUR, -36)
start = cal.getTime()

results = system.alert.queryAlertHistory("DBHistory", start, end, activeAndAcked=0, clearAndAck

if results.rowCount > 0:
   system.gui.messageBox("There are %d un-acked alerts!" % results.rowCount)
```

11.3.3 system.alert.queryAlertStatus

Description

Queries the alerting system for the current status of all alerts. By default, flatten mode is on, which means that you will get a single entry per alert path. If you turn flatten off, you'll get a row for *each state* of the alert. This can be important for alerts that have overlapping states.

The results of this function are a dataset with the following columns:
System - The system that issued the alert.
Path - The path to the alert item
Display Path - The custom display path (if any) for the alert. Will be the Path if no Display Path is configured.
State Name - The state name for the alert. If flatten is true, this will be the highest severity active alert state. If no state is active, this will be the most recently cleared alert state.
Severity - The severity, as a string.
Severity Code - The severity as an integer. 0-4, low-high.
Active - A boolean indicating whether this alert state is currently active.
Active Timestamp - The time at which this alert went active. May be null.
Active Value - The value that triggered this alert to go active.
Cleared - A boolean indicating whether this alert is currently clear.

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Cleared Timestamp - The time at which this alert cleared. May be null.
Cleared Value - The value that cleared the alert.
Acked - A boolean indicating whether or not this alert has been acknowledged.
Ack Timestamp - The time that the alert was acknowledged. May be null.
Ack user - The user who acknowledged the alert.
Notes - The notes field for the alert
Flags - A bitmask representing the current alert state. 0x01= Active, 0x02=Cleared, 0x04=Acknowledged. So if the alert is active and acknowledged, but not cleared, this will be 0x01 | 0x04 = 5;

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

```
system.alert.queryAlertStatus(system, path, stateName, minSeverity, maxSeverity, activeAndUnacked, activeAndAcked, clearAndUnacked, clearAndAcked, flatten, displayPath)
```

Parameters

String `system` - Filter string to restrict results based on the alert system.
String `path` - Filter string to restrict results based on the alert path.
String `stateName` - Filter string to restrict results based on the alert state name.
Integer `minSeverity` - Minimum severity to return. Defaults to 0 (Low).
Integer `maxSeverity` - Maximum severity to return. Defaults to 4 (High).
Boolean `activeAndUnacked` - Whether or not to return alerts that are currently active and unacknowledged. Default is true.
Boolean `activeAndAcked` - Whether or not to return alerts that are currently active and have been acknowledged. Default is false.
Boolean `clearAndUnacked` - Whether or not to return alerts that are cleared and unacknowledged. Default is false.
Boolean `clearAndAcked` - Whether or not to return alerts that are cleared and have been acknowledged. Default is false.
Boolean `flatten` - If true, will flatten results so that there is only one entry per alert path, matching the highest active state. Default is true.
String `displayPath` - Filter string to restrict results based on the alert's display path.

Returns

Dataset - A dataset containing the alerts in the system that match the filters.

Scope

All

Examples

This script will query the alert status for currently active alerts and push the results into a table.

```
results = system.alert.queryAlertStatus(flatten=1,activeAndUnacked=1, activeAndAcked=1)
event.source.parent.getComponent("Table").data=results
```

This *expression binding* will return the count of currently active alerts with a severity of Medium or higher, checking once a second.

```
runScript(
    "system.alert.queryAlertStatus(activeAndAcked=1, minSeverity=2).rowCount",
    1000
)
```

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11.4 system.dataset

11.4.1 system.dataset.addColumn

Syntax

```
system.dataset.addColumn(dataset[, colIndex], col, colName, colType)
```

Parameters

Dataset `dataset` - The starting dataset. Please be aware that this dataset will not actually be modified (datasets are immutable), but rather will be the starting point for creating a new dataset.

int `colIndex` - The index (starting at 0) at which to insert the new column. Will throw an IndexError if less than zero or greater than the length of the dataset. If omitted, the new column will be appended to the end. [optional]

PySequence `col` - A Python sequence representing the data for the new column. Its length must equal the number of rows in the dataset.

String `colName` - The name of the column.

PyType `colType` - The type of the of the column. The type can be the python equivalent of String,Long,Double,Short,Integer, Float,Boolean,null,java.util.Date if they exist. For example, the type can be found for a python long variable by "type(long)". The result of "type(long)" can be used as the colType parameter.

Returns

Dataset - A new dataset with the new column inserted or appended.

Scope

All

11.4.2 system.dataset.addRow

Description

Takes a dataset and returns a new dataset with a new row added or inserted into it. Datasets are immutable, so it is important to realize that this function does not actually add a row to a dataset. You'll need to do something with the new dataset that this function creates to achieve something useful. If the `rowIndex` argument is omitted, the row will be appended to the end of the dataset.

Syntax

```
system.dataset.addRow(dataset[, rowIndex], row)
```

Parameters

Dataset `dataset` - The starting dataset. Please be aware that this dataset will not actually be modified (datasets are immutable), but rather will be the starting point for creating a new dataset.

int `rowIndex` - The index (starting at 0) at which to insert the new row. Will throw an IndexError if less than zero or greater than the length of the dataset. If omitted, the new row will be appended to the end. [optional]

PySequence `row` - A Python sequence representing the data for the new row. Its length must equal the number of columns in the dataset.

Returns

Dataset - A new dataset with the new row inserted or appended.

Scope

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All

Examples

This example would add a new option to a Dropdown List by adding a row to its underlying dataset. Notice how the last line *assigns* the return value of the `addRow` function to the dropdown's `data` property.

```
dropdown = event.source.parent.getComponent("Dropdown")
newRow = [5, "New Option"]
dropdown.data = system.dataset.addRow(dropdown.data, newRow)
```

This snippet would add a new option into a Dropdown component just like above, but at the beginning:

```
dropdown = event.source.parent.getComponent("Dropdown")
newRow = [5, "New Option"]
dropdown.data = system.dataset.addRow(dropdown.data, 0, newRow)
```

11.4.3 system.dataset.dataSetToExcel

Description

Formats the contents of one or more datasets as an excel spreadsheet, returning the results as a string. Each dataset specified will be added as a worksheet in the Excel workbook. This function uses an xml-format for Excel spreadsheets, not the native Excel file format.

Syntax

```
system.dataset.dataSetToExcel(showHeaders, datasets)
```

Parameters

boolean `showHeaders` - If true (1), the spreadsheet will include a header row.

Object[] `datasets` - A sequence of datasets, one for each sheet in the resulting workbook.

Returns

String - An Excel-compatible XML-based workbook, with one worksheet per dataset.

Scope

All

Examples

This snippet would run a SQL query against a database, and turn the results into a string that is XML that Excel can open. It then writes the string to a file on the local hard drive.

```
results = system.db.runQuery("SELECT * FROM example1 LIMIT 100")
results = system.dataset.toDataSet(results)
spreadsheet = system.dataset.dataSetToExcel(1, [results])
filePath = "C:\\output\\results.xls"
system.file.writeFile(filePath, spreadsheet)
```

See also:
system.dataset.exportExcel

11.4.4 system.dataset.dataSetToHTML

Description

Formats the contents of a dataset as an HTML page, returning the results as a string. Uses the <table> element to create a data table page.

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Syntax

```
system.dataset.dataSetToHTML(showHeaders, dataset, title)
```

Parameters

boolean `showHeaders` - If true(1), the HTML table will include a header row.
Dataset `dataset` - The dataset to export
String `title` - The title for the HTML page.

Returns

String - The HTML page as a string.

Scope

All

Examples

This snippet would run a SQL query against a database, and turn the results into a string containing HTML. It then writes the string to a file on the local hard drive.

```
results = system.db.runQuery("SELECT * FROM example1 LIMIT 100")
results = system.dataset.toDataSet(results)
html = system.dataset.dataSetToHTML(1, results, "Production Report")
filePath = "C:\\output\\results.html"
system.file.writeFile(filePath, html)
```

See also:
system.dataset.exportHTML

11.4.5 system.dataset.deleteRow

Description

Takes a dataset and returns a new dataset with a row removed. Datasets are immutable, so it is important to realize that this function does not actually remove the row from the argument dataset. You'll need to do something with the new dataset that this function creates to achieve something useful.

Syntax

```
system.dataset.deleteRow(dataset, rowIndex)
```

Parameters

Dataset `dataset` - The starting dataset. Please be aware that this dataset will not actually be modified (datasets are immutable), but rather will be the starting point for creating a new dataset.
int `rowIndex` - The index (starting at 0) of the row to delete. Will throw an IndexError if less than zero or greater than len(dataset)-1.

Returns

Dataset - A new dataset with the specified row removed.

Scope

All

Examples

This example would remove the selected row from a List component, by re-assigning the List's `data` property to the new dataset returned by the `deleteRow` function.

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```
myList = event.source.parent.getComponent("List")
row = myList.selectedIndex
if row != -1: # make sure there is something selected
   myList.data = system.dataset.deleteRow(myList.data, row)
```

11.4.6 system.dataset.exportCSV

Description

Exports the contents of a dataset as a CSV file, prompting the user to save the file to disk.

Syntax

system.dataset.**exportCSV(**filename, showHeaders, dataset**)**

Parameters

String `filename` - A suggested filename to save as.
boolean `showHeaders` - If true (1), the CSV file will include a header row.
Dataset `dataset` - The dataset to export.

Returns

String - The path to the saved file, or None if the action was canceled by the user.

Scope

Client

Examples

This snippet would prompt the user to save the data currently displayed in a Table component to a CSV file, and would open the file (in an external program, presumably Excel) after a successful save.

```
table = event.source.parent.getComponent("Table")
filePath = system.dataset.exportCSV("data.csv", 1, table.data)
if filePath != None:
   system.net.openURL("file://"+filePath)
```

See also:
system.dataset.dataSetToCSV

11.4.7 system.dataset.exportExcel

Description

Exports the contents of a dataset as an Excel spreadsheet, prompting the user to save the file to disk. Uses the same format as the `dataSetToExcel` function.

Syntax

system.dataset.**exportExcel(**filename, showHeaders, dataset**)**

Parameters

String `filename` - A suggested filename to save as.
boolean `showHeaders` - If true (1), the spreadsheet will include a header row.
Object[] `dataset` - A sequence of datasets, one for each sheet in the resulting workbook.

Returns

String - The path to the saved file, or None if the action was canceled by the user.

Scope

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Client

Examples

This snippet would prompt the user to save the data currently displayed in a Table component to an Excel-compatible spreadsheet file, and would open the file after a successful save.

```
table = event.source.parent.getComponent("Table")
filePath = system.dataset.exportExcel("data.xls", 1, table.data)
if filePath != None:
   system.net.openURL("file://"+filePath)
```

See also:
system.dataset.dataSetToExcel

11.4.8 system.dataset.exportHTML

Description

Exports the contents of a dataset to an HTML page. Prompts the user to save the file to disk.

Syntax

```
system.dataset.exportHTML(filename, showHeaders, dataset, title)
```

Parameters

String `filename` - A suggested filename to save as.
boolean `showHeaders` - If true (1), the HTML tabl will include a header row.
Dataset `dataset` - The dataset to export.
String `title` - The title for the HTML page.

Returns

String - The path to the saved file, or None if the action was canceled by the user.

Scope

Client

Examples

This snippet would prompt the user to save the data currently displayed in a Table component to an HTML file, and would open the file in the default web browser after a successful save.

```
table = event.source.parent.getComponent("Table")
filePath = system.dataset.exportHTML("data.html", 1, table.data,"Production Report")
if filePath != None:
   system.net.openURL("file://"+filePath)
```

See also:
system.dataset.exportHTML

11.4.9 system.dataset.fromCSV

Description

Converts a dataset stored in a CSV formatted string to a dataset that can be immediately assignable to a dataset property in your project. Usually this is used in conjunction with system.file.readFileAsString when reading in a CSV file that was exported using system.dataset.exportCSV. The CSV string must be formatted in a specific way:

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```
"#NAMES"
"Col 1","Col 2","Col 3"
"#TYPES"
"I","str","D"
"#ROWS","6"
"44","Test Row 2","1.8713151369491254"
"86","Test Row 3","97.4913421614675"
"0","Test Row 8","20.39722542161364"
"78","Test Row 9","34.57127071614745"
"20","Test Row 10","76.41114659745085"
"21","Test Row 13","13.880548366871926"
```

The first line must be "#NAMES"
The second line must list the names of the columns of the datset, each in quotes and separated by commas
The third line must be "#TYPES"
The fourth line must list the type of each column of the dataset in order
- Integer = "I"
- String = "str"
- Double = "D"
- Date = "date"
- Long = "L"
- Short = "S"
- Float = "F"
- Boolean = "B"

The fifth line must be "#ROWS" followed by a comma and then the number of rows of data in quotes (i.e. "#ROWS", "6")
The following lines will be your data, each column value surrounded in quotes and separated by a comma; each row on a separate line. The number of rows must match what was specified on line 5

Syntax

```
system.dataset.fromCSV(csv)
```

Parameters

String `csv` - A string holding a CSV dataset.

Returns

Dataset - A new dataset.

Scope

All

Examples

In this example it is assumed that the CSV file being read was a dataset that was previously exported using system.dataset.exportCSV:

```
#Specify file path
file_path = "C:\\my_dataset.csv"
#Read in the file as a string
data_string = system.file.readFileAsString(file_path)
#Convert the string to a dataset and store in a variable
data = system.dataset.fromCSV(data_string)
#Assign the dataset to a table
event.source.parent.getComponent('Table').data = data
```

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11.4.10 system.dataset.getColumnHeaders

Syntax

```
system.dataset.getColumnHeaders(dataset)
```

Parameters

Dataset `dataset` - The input dataset.

Returns

PyList - A list of column header strings.

Scope

All

11.4.11 system.dataset.setValue

Description

Takes a dataset and returns a new dataset with a one value altered. Datasets are immutable, so it is important to realize that this function does not actually set a value in the argument dataset. You'll need to do something with the new dataset that this function creates to achieve something useful.

Syntax

```
system.dataset.setValue(dataset, rowIndex, columnIndex, value)
```

Parameters

Dataset `dataset` - The starting dataset. Will not be modified (datasets are immutable), but acts as the basis for the returned dataset.

int `rowIndex` - The index of the row to set the value at (starting at 0)

int `columnIndex` - The index of the column to set the value at (starting at 0)

PyObject `value` - The new value for the specified row/column.

Returns

Dataset - A new dataset, with the new value set at the given location.

Scope

All

```
system.dataset.setValue(dataset, rowIndex, columnName, value)
```

Parameters

Dataset `dataset` - The starting dataset. Will not be modified (datasets are immutable), but acts as the basis for the returned dataset.

int `rowIndex` - The index of the row to set the value at (starting at 0)

String `columnName` - The name of the column to set the value at. Case insensitive.

PyObject `value` - The new value for the specified row/column.

Returns

Dataset - A new dataset, with the new value set at the given location.

Scope

All

Examples

This snippet could be used for a Button's `actionPerformed` event to change the selected cell's value in a Table component to zero.

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```
table = event.source.parent.getComponent("Table")
selRow = table.getSelectedRow()
selCol = table.getSelectedColumn()
if selRow != -1 and selCol != -1:
   newData = system.dataset.setValue(table.data, selRow, selCol, 0.0)
   table.data = newData
```

11.4.12 system.dataset.sort

Syntax

system.dataset.**sort(**dataset, keyColumn **[**, ascending**])**

Parameters

Dataset `dataset` - The dataset to sort.

int `keyColumn` - The index or column name of the column to sort on.

boolean `ascending` - True for ascending order, False for descending order. [optional]

Returns

Dataset - A new sorted dataset.

Scope

All

system.dataset.**sort(**dataset, keyColumn **[**, ascending**])**

Parameters

Dataset `dataset` - The dataset to sort.

String `keyColumn` - The index or column name of the column to sort on.

boolean `ascending` - True for ascending order, False for descending order. [optional]

Returns

Dataset - A new sorted dataset.

Scope

All

11.4.13 system.dataset.toCSV

Syntax

system.dataset.**toCSV(**dataset, showHeaders, forExport**)**

Parameters

Dataset `dataset` - The dataset to export to CSV.

Boolean `showHeaders` - If set to true(1), a header row will be present in the CSV. Default is true(1).

Boolean `forExport` - If set to true(1), extra header information will be present in the CSV data which is necessary for the CSV to be compatible with the fromCSV method. Overrides showHeaders. Default is false(0).

Returns

String - The CSV data as a string

Scope

All

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11.4.14 system.dataset.toDataSet

Description

This function is used to 1) convert PyDataSets to DataSets, and 2) create new datasets from raw Python lists. See also: Working with Datatypes / Datasets.

Syntax

```
system.dataset.toDataSet(dataset)
```

Parameters

PyDataSet `dataset` - A PyDataSet object to convert.

Returns

Dataset - The newly created dataset.

Scope

All

```
system.dataset.toDataSet(headers, data)
```

Parameters

PySequence `headers` - The column names for the dataset to create.

PySequence `data` - A list of rows for the new dataset. Each row must have the same length as the headers list, and each value in a column must be the same type.

Returns

Dataset - The newly created dataset.

Scope

All

Examples

This first example shows how this function can be used to convert from a PyDataSet (which is what system.db.runQuery returns) to a normal DataSet, which is the datatype of a Table component's `data` property.

```
pyDataSet = system.db.runQuery("SELECT * FROM example1 LIMIT 100")
table = event.source.parent.getComponent("Table")
normalDataSet = system.dataset.toDataSet(pyDataSet)
table.data = normalDataSet
```

This second example shows how to use this function to create a new dataset out of a python sequence that you have filled in. In this case, the sequence is created via a for loop appending rows to a list.

```
#  Generate the Rows
rows = []
for x in range(10):
   oneRow = ["Row %d" % x, x+15]
   rows.append(oneRow)

# Generate the DataSet
headers = ["RowID", "Value"]
data = system.dataset.toDataSet(headers, rows)

# Use our new dataset to fill in a Table
table = event.source.parent.getComponent("Table")
```

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```
table.data = data
```

11.4.15 system.dataset.toPyDataSet

Description

This function converts from a normal DataSet to a PyDataSet, which is a wrapper class which makes working with datasets more Python-esque. See also: Working with Datatypes / Datasets.

Syntax

```
system.dataset.toPyDataSet(dataset)
```

Parameters

Dataset `dataset` - A DataSet object to convert into a PyDataSet.

Returns

PyDataSet - The newly created PyDataSet.

Scope

All

Examples

This example script would be added to a button that is in the same container as the table you are working with. It grabs the data of the Table component, and adds up the values in the column named "Value", displaying the result to the user.

```
# Get a Table component's data
table = event.source.parent.getComponent("Table")
data = system.dataset.toPyDataSet(table.data)

# Loop through the data, summing the Value column
value = 0.0
for row in data:
   value += row["Value"]

# Show the user the sum of the Value column
system.gui.messageBox("The value is: %f" % value)
```

11.4.16 system.dataset.updateRow

Description

Takes a dataset and returns a new dataset with a one row altered. Datasets are immutable, so it is important to realize that this function does not actually change the row in the argument dataset. You'll need to do something with the new dataset that this function creates to achieve something useful.

To alter the row, this function takes a Python dictionary to represent the changes to make to the specified row. The keys in the dictionary are used to find the columns to alter. See also: Sequences and Dictionaries.

Syntax

```
system.dataset.updateRow(dataset, rowIndex, changes)
```

Parameters

Dataset `dataset` - The starting dataset. Will not be modified (datasets are immutable), but

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acts as the basis for the returned dataset.

int `rowIndex` - The index of the row to update (starting at 0)

PyDictionary `changes` - A Dictionary of changes to make. They keys in the dictionary should match column names in the dataset, and their values will be used to update the row.

Returns

Dataset - A new dataset with the values at the specified row updated according to the values in the dictionary.

Scope

All

Examples

This example could be used to dynamically change the data that an Easy Chart displays. In this simple example, we assume that the chart is always configured to display a single tank's level. This script would update the pen being displayed using a dynamic tank number.

```
# Generate new tag name and tag path
tankNumber = 5
newName = "Tank%d Level" % tankNumber
newPath = "Tanks/Tank%d/Level" % tankNumber

# Consolidate changes into a dictionary
updates = {"NAME": newName, "TAG_PATH":newPath}

# Update the Easy Chart
chart = event.source.parent.getComponent("Easy Chart")
newPens = system.dataset.updateRow(chart.tagPens, 0, updates)
chart.tagPens = newPens
```

11.5 system.db

11.5.1 system.db.beginTransaction

Description

Begins a new database transaction. Database transactions are used to execute multiple queries in an atomic fashion. After executing queries, you must either *commit* the transaction to have your changes take effect, or *rollback* the transaction which will make all operations since the last commit not take place. The transaction is given a new unique string code, which is then returned. You can then use this code as the `tx` argument for other `system.db.*` function calls to execute various types of queries using this transaction.

An open transaction consumes one database connection until it is closed. Because leaving connections open indefinitely would exhaust the connection pool, each transaction is given a timeout. Each time the transaction is used, the timeout timer is reset. For example, if you make a transaction with a timeout of one minute, you must use that transaction at least once a minute. If a transaction is detected to have timed out, it will be automatically closed and its transaction id will no longer be valid.

Syntax

```
system.db.beginTransaction(database, isolationLevel, timeout)
```

Parameters

String `database` - The name of the database connection to create a transaction in. Use "" for the project's default connection.

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Integer `isolationLevel` - The transaction isolation level to use. Use one of the four constants: system.db.READ_COMMITTED, system.db.READ_UNCOMMITTED, system.db.REPEATABLE_READ, or system.db.SERIALIZABLE

Long `timeout` - The amount of time, in milliseconds, that this connection is allowed to remain open without being used. Timeout counter is reset any time a query or call is executed against the transaction, or when committed or rolled-back.

Returns

String - The new transaction ID. You'll use this ID as the "tx" argument for all other calls to have them execute against this transaction.

Scope

All

Examples

This example would start a transaction with a 5 second timeout against the project's default database, using the default isolation level. Then it executes a series of update calls, and commits and closes the transaction.

```
txId = system.db.beginTransaction(timeout=5000)
status=2

for machineId in range(8):
   system.db.runPrepUpdate("UPDATE MachineStatus SET status=? WHERE ID=?", args=[status, machin

system.db.commitTransaction(txId)
system.db.closeTransaction(txId)
```

11.5.2 system.db.closeTransaction

Description

Closes the transaction with the given ID. Note that you must commit or rollback the transaction before you close it. Closing the transaction will return it's database connection to the pool. The transaction ID will no longer be valid.

Syntax

```
system.db.closeTransaction(tx)
```

Parameters

String `tx` - The transaction ID.

Returns

nothing

Scope

All

11.5.3 system.db.commitTransaction

Description

Performs a commit for the given transaction. This will make all statements executed against the transaction since its beginning or since the last commit or rollback take effect in the database. Until you commit a transaction, any changes that the transaction makes will not be visible to other connections. Note that if you are done with the transaction, you must close it afterward you commit it.

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Syntax

```
system.db.commitTransaction(tx)
```

Parameters

String `tx` - The transaction ID.

Returns

nothing

Scope

All

11.5.4 system.db.createSProcCall

Description

Creates an **SProcCall** object, which is a stored procedure *call context*. This is an object that is used to configure a call to a stored procedure. Once configured, you'd use system.db.execSProcCall to call the stored procedure. The call context object then holds any results from the stored procedure.

The SProcCall object has the following functions used for registering parameters:

`SPRocCall.registerInParam`(`index` *OR* `name`, `typeCode`, `value`)
`SPRocCall.registerOutParam`(`index` *OR* `name`, `typeCode`)
`SPRocCall.registerReturnParam`(`typeCode`)

These functions are used to register any in/out parameters for the stored procedure. Parameters can be referenced by index (starting at 1, not 0), or by name. To register an in/out parameter, you simply register it twice - once as an input parameter with the value you'd like to pass to the stored procedure, and once as an output parameter. N.B. not all JDBC drivers support named procedure parameters.

If your function returns a value, you must use `registerReturnParam` to specify the datatype of the returned value. Note that this is different from stored procedures that return a *result set*, which doesn't require any setup on the SProcCall object. Some database systems call stored procedures that return a value "functions" instead of "procedures".

For all of these functions, you'll need to specify a *type code*. These are codes defined by the JDBC specification. For your convenience, the codes exist as constants in the `system.db` namespace. Each type code will be mapped to a database-specific type by the JDBC driver. Not all type codes will be recognized by all JDBC drivers. The following type code constants are available:

BIT	REAL	LOGVARCHAR	LONGVARBINARY	BLOB	NCHAR
TINYINT	DOUBLE	DATE	NULL	CLOB	NVARCHAR
SMALLINT	NUMERIC	TIME	OTHER	REF	LONGNVARCHAR
INTEGER	DECIMAL	TIMESTAMP	DISTINCT	DATALINK	NCLOB
BIGINT	CHAR	BINARY	STRUCT	BOOLEAN	SQLXML
FLOAT	VARCHAR	VARBINARY	ARRAY	ROWID	ORACLE_CURSOR

Once the call context has been executed, you can retrieve the result set, return value, and output

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parameter values (if applicable) by calling the following functions:

SProcCall.getResultSet() - returns a dataset that is the resulting data of the stored procedure, if any.
SProcCall.getUpdateCount() - returns the number of rows modified by the stored procedure, or -1 if not applicable.
SProcCall.getReturnValue() - returns the return value, if registerReturnParam had been called.
SProcCall.getOutParamValue(`index` *OR* `name`) - returns the value of the previously registered out-parameter.

Syntax

system.db.**createSProcCall(**procedureName, database, tx, skipAudit**)**

Parameters

String `procedureName` - The named of the stored procedure to call.
String `database` - The name of the database connection to execute against. If omitted or "", the project's default database connection will be used.
String `tx` - A transaction identifier. If omitted, the call will be executed in its own transaction.
boolean `skipAudit`

Returns

SProcCall - A stored procedure call context, which can be configured and then used as the argument to system.db.execSProcCall.

Scope

All

Examples

This example would call a stored procedure named "start_batch" against the current project's default database connection that had no input or output parameters, and did not return any values or results:

```
call = system.db.createSProcCall("start_batch")
system.db.execSProcCall(call)
```

This example would call a stored procedure "get_shift_workers" with no arguments, which returned a result set of employees for the current shift. It then pushes the resulting dataset into a Table component:

```
call = system.db.createSProcCall("get_shift_workers")
system.db.execSProcCall(call)

results = call.getResultSet()
table = event.source.parent.getComponent("Table")
table.data = results
```

This example would call a stored procedure that took two arguments, the first an integer and the second a string. It also is configured to return an integer value.

```
call = system.db.createSProcCall("perform_calculation")
call.registerReturnParam(system.db.INTEGER)
call.registerInParam(1, system.db.INTEGER, 42)
call.registerInParam(2, system.db.VARCHAR, "DC-MODE")

system.db.execSProcCall(call)
```

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```
#Print the result to the console
print call.getReturnValue()
```

This example would do the same as the one above, except for a stored procedure that returned its value using an out-parameter. It also uses named argument names instead of indexed arguments.

```
call = system.db.createSProcCall("perform_calculation")
call.registerInParam("arg_one", system.db.INTEGER, 42)
call.registerInParam("arg_two", system.db.VARCHAR, "DC-MODE")
call.registerOutParam("output_arg", system.db.INTEGER)

system.db.execSProcCall(call)

#Print the result to the console
print call.getOutParamValue("output_arg")
```

11.5.5 system.db.dateFormat

Description

This function is used to format Dates nicely as strings. It uses a *format string* to guide its formatting behavior. Learn more about date formatting in Working with Datatypes / Dates

Expert Tip: This function uses the Java class java.text.SimpleDateFormat internally, and will accept any valid format string for that class.

Syntax

```
system.db.dateFormat(date, formatPattern)
```

Parameters

Date `date` - The Date object that you'd like to format

String `formatPattern` - A format pattern string to apply.

Returns

String - The date as a string formatted according to the format pattern.

Scope

All

Examples

This example will display a message box on a button press that displays the selected date (without the time) from a Calendar component, in a format like "Feb 3, 2009"

```
date = event.source.parent.getComponent("Calendar").latchedDate
toDisplay = system.db.dateFormat(date, "MMM d, yyyy")
system.gui.messageBox("The date you selected is: %s" % toDisplay)
```

This example would do the same as the one above, but also display the time, in a format like: "Feb 3, 2009 8:01pm"

```
date = event.source.parent.getComponent("Calendar").latchedDate
toDisplay = system.db.dateFormat(date, "MMM d, yyyy")
system.gui.messageBox("The date you selected is: %s" % toDisplay)
```

This example would take two dates from two Popup Calendar components, format them in a manner that the database understands, and then use them in a SQL query to limit the results to a certain date range.

```
startDate = event.source.parent.getComponent("StartDate").date
endDate = event.source.parent.getComponent("EndDate").date
```

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```
startDate = system.db.dateFormat(startDate, "yyyy-MM-dd HH:mm:ss")
endDate = system.db.dateFormat(endDate, "yyyy-MM-dd HH:mm:ss")
query = "SELECT * FROM mytable WHERE t_stamp >= '%s' AND t_stamp <= '%s'" % (startDate, endDate
results = system.db.runQuery(query)
event.source.parent.getComponent("Table").data = results
```

11.5.6 system.db.execSProcCall

Description

Executes a stored procedure call. The one parameter to this function is an **SProcCall** - a stored procedure *call context*. See the description of system.db.createSProcCall for more information and examples.

Syntax

```
system.db.execSProcCall(callContext)
```

Parameters

SProcCall `callContext` - A stored procedure call context, with any input, output, and/or return value parameters correctly configured. Use system.db.createSProcCall to create a call context.

Returns

nothing

Scope

All

11.5.7 system.db.getConnectionInfo

Description

Returns a dataset of information about a single database connection, as specified by the `name` argument.

Syntax

```
system.db.getConnectionInfo(name)
```

Parameters

String `name` - The name of the database connection to find information about.

Returns

Dataset - A dataset containing information about the named database connection, or an empty dataset if the connection wasn't found.

Scope

All

11.5.8 system.db.getConnections

Description

Returns a dataset of information about each configured database connection. Each row represents a single connection.

Syntax

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```
system.db.getConnections()
```

Parameters
none

Returns
Dataset - A dataset, where each row represents a database connection.

Scope
All

11.5.9 system.db.refresh

Description

This function will programmatically cause a SQL Query or DB Browse property binding to execute immediately. This is most often used for bindings that are set to *Polling - Off*. In this way, you cause a binding to execute on demand, when you know that the results of it's query will return a new result. To use it, you simply specify the component and name of the property on whose binding you'd like to refresh.

Syntax

```
system.db.refresh(component, propertyName)
```

Parameters
JComponent `component` - The component whose property you want to refresh
String `propertyName` - The name of the property that has a SQL Query binding that needs to be refreshed

Returns
boolean - True (1) if the property was found and refreshed successfully.

Scope
Client

Examples

This example could be placed in the actionPerformed event of a Button, to be used to refresh the data of a Table. Remember to use the *scripting name* of the property that you're trying to refresh, and that the property names are case-sensitive.

```
table = event.source.parent.getComponent("Table")
system.db.refresh(table, "data")
```

11.5.10 system.db.rollbackTransaction

Description

Performs a rollback on the given connection. This will make all statements executed against this transaction since its beginning or since the last commit or rollback undone. Note that if you are done with the transaction, you must also close it afterward you do a rollback on it.

Syntax

```
system.db.rollbackTransaction(tx)
```

Parameters
String `tx` - The transaction ID.

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Returns
nothing

Scope
All

11.5.11 system.db.runPrepQuery

Description

Runs a *prepared statement* against the database, returning the results in a PyDataSet.. Prepared statements differ from regular queries in that they can use a special placeholder, the question-mark character (`?`) in the query where any dynamic arguments would go, and then use an array of values to provide real information for those arguments. Make sure that the length of your argument array matches the number of question-mark placeholders in your query. This call should be used for SELECT queries.

This is a useful alternative to system.db.runQuery because it allows values in the WHERE clause, JOIN clause, and other clauses to be specified without having to turn those values into *strings*. This is safer because it protects against a problem known as a SQL injection attack, where a user can input data that affects the query's semantics.

Syntax

system.db.**runPrepQuery(**query, args, database, tx**)**

Parameters
String `query` - A query (typically a SELECT) to run as a prepared statement, with placeholders (?) denoting where the arguments go.
Object[] `args` - A list of arguments. Will be used in order to match each placeholder (?) found in the query.
String `database` - The name of the database connection to execute against. If omitted or "", the project's default database connection will be used.
String `tx` - A transaction identifier. If omitted, the query will be executed in its own transaction.

Returns
PyDataSet - The results of the query as a PyDataSet

Scope
All

Examples

This example would search for all records in a LogEntry table where the message contained a user-entered search term.

```
search = event.source.parent.getComponent("SearchFor").text
# Wrap the term in % signs for LIKE-style matching
search = '%' + search + '%'

results= system.db.runPrepQuery("SELECT * FROM LogEntry WHERE EntryText LIKE ?", [search])
event.source.parent.getComponent("Table").data = results
```

11.5.12 system.db.runPrepUpdate

Description

Runs a *prepared statement* against the database, returning the number of rows that were affected. Prepared statements differ from regular queries in that they can use a special placeholder, the question-mark character (`?`) in the query where any dynamic arguments would go, and then use an array of values to provide real information for those arguments. Make sure that the length of your argument array matches the number of question-mark placeholders in your query. This call should be used for UPDATE, INSERT, and DELETE queries.

This is extremely useful for two purposes:

1. This method avoids the problematic technique of concatenating user input inside of a query, which can lead to syntax errors, or worse, a nasty security problem called a SQL injection attack. For example, if you have a user-supplied string that is used in a WHERE clause, you use single-quotes to enclose the string to make the query valid. What happens in the user has a single-quote in their text? Your query will fail. Prepared statements are immune to this problem.
2. This is the only way to write an INSERT or UPDATE query that has binary or BLOB data. Using BLOBs can be very hand for storing images or reports in the database, where all clients have access to them.

Syntax

system.db.**runPrepUpdate(**query, args, database, tx, getKey, skipAudit**)**

Parameters

String `query` - A query (typically an UPDATE, INSERT, or DELETE) to run as a prepared statement, with placeholders (?) denoting where the arguments go.

Object[] `args` - A list of arguments. Will be used in order to match each placeholder (?) found in the query.

String `database` - The name of the database connection to execute against. If omitted or "", the project's default database connection will be used.

String `tx` - A transaction identifier. If omitted, the update will be executed in its own transaction.

Boolean `getKey` - A flag indicating whether or not the result should be the number of rows returned (getKey=0) or the newly generated key value that was created as a result of the update (getKey=1). Not all databases support automatic retrieval of generated keys.

Boolean `skipAudit` - A flag which, if set to true, will cause the prep update to skip the audit system. Useful for some queries that have fields which won't fit into the audit log.

Returns

Integer - The number of rows affected by the query, or the key value that was generated, depending on the value of the getKey flag.

Scope

All

Examples

This example would gather some user entered text and insert it into the database.

```
userText = event.source.parent.getComponent("TextArea").text
userName = system.security.getUsername()
system.db.runPrepUpdate("INSERT INTO Comments (Name, UserComment) VALUES (?,?)", [userName, use
```

This code would read a file and upload it to the database

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```
filename = system.file.openFile() # Ask the user to open a file
if filename != None:
   filedata = system.file.readFileAsBytes(filename)
   system.db.runPrepUpdate("INSERT INTO Files (file_data) VALUES (?)", [filedata])
```

This example inserts a new user and gives it the 'admin' role. Demonstrates the ability to retrieve a newly created key value.

```
#get the username/password
name = event.source.parent.getComponent('Name').text
desc = event.source.parent.getComponent('Description').text
building = event.source.parent.getComponent('Building').selectedValue

#insert the value
id = system.db.runPrepUpdate("INSERT INTO machines (machine_name, description) VALUES (?, ?)",

#add a row to the user role mapping table
system.db.runPrepUpdate("INSERT INTO machine_building_mapping (machine_id, building) VALUES (?,
```

11.5.13 system.db.runQuery

Description

Runs a SQL query, usually a SELECT query, against a database, returning the results as a dataset. If no database is specified, or the database is the empty-string "", then the current project's default database connection will be used. The results are returned as a PyDataSet, which is a wrapper around the standard dataset that is convenient for scripting. See also: Working with Datatypes / Datasets.

Syntax

```
system.db.runQuery(query, database, tx)
```

Parameters

String `query` - A SQL query, usually a SELECT query, to run.
String `database` - The name of the database connection to execute against. If omitted or "", the project's default database connection will be used.
String `tx` - A transaction identifier. If omitted, the query will be executed in its own transaction.

Returns

PyDataSet - The results of the query as a PyDataSet.

Scope

All

Examples

Assuming the following dataset:

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	Value
	3.55
	67.2
	9.87

If you executed the following code:

```
table = system.db.runQuery("SELECT * FROM TEST")
```

then `table[2]` would access the third row (rows are zero-indexed), and both `table[2][0]` and `table[2]["ID"]` would access the ID value of the third row. As further example of how to use the results of runQuery, here are seven different ways to print out the table, and their results follow. Note that some of the later methods exercise some more advanced Jython concepts such as list comprehensions and string formatting, but their intent should be obvious. Generally speaking, the more concise Jython code becomes, the more readable it is.

```
table = system.db.runQuery("SELECT * FROM Test")

print "Printing TEST Method 1..."
for row in table:
   for col in row:
      print col,
   print ""
print ""

print "Printing TEST Method 2..."
for row in table:
   print row[0], row[1]
print ""

print "Printing TEST Method 3..."
for row in table:
   print row["ID"], row["VALUE"]
print ""

print "Printing TEST Method 4..."
for rowIdx in range(len(table)):
   print "Row ",str(rowIdx)+": ", table[rowIdx][0], table[rowIdx][1]
print ""

print "Printing TEST Method 5..."
print [str(row[0])+", "+ str(row[1]) for row in table]
print ""

print "Printing TEST Method 6..."
print ["%s, %s" % (row["ID"],row["VALUE"]) for row in table]
print ""

print "Printing TEST Method 7..."
print [[col for col in row] for row in table]
print ""
```

The results printed out would be:

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```
Printing TEST Method 1...
0 3.55
1 67.2
2 9.87

Printing TEST Method 2...
0 3.55
1 67.2
2 9.87

Printing TEST Method 3...
0 3.55
1 67.2
2 9.87

Printing TEST Method 4...
Row 0: 0 3.55
Row 1: 1 67.2
Row 2: 2 9.87

Printing TEST Method 5...
['0, 3.55', '1, 67.2', '2, 9.87']

Printing TEST Method 6...
['0, 3.55', '1, 67.2', '2, 9.87']

Printing TEST Method 7...
[[0, 3.55], [1, 67.2], [2, 9.87]]
```

11.5.14 system.db.runScalarQuery

Description

Runs a query against a database connection just like the `runQuery` function, but only returns the value from the first row and column. If no results are returned from the query, the special value `None` is returned.

Syntax

system.db.**runScalarQuery(**query, database, tx**)**

Parameters

String `query` - A SQL query that should be designed to return one row and one column.
String `database` - The name of the database connection to execute against. If omitted or "", the project's default database connection will be used.
String `tx` - A transaction identifier. If omitted, the query will be executed in its own transaction.

Returns

Object - The value from the first row and first column of the results. Returns None if no rows were returned.

Scope

All

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Examples

Example 1:

This code would count the number of active alarms, and acknowledge them all if there is at least one.

```
numAlarms = system.db.runScalarQuery("SELECT COUNT(*) FROM alarmstatus WHERE unacknowledged = 1
if numAlarms > 0:
   # There are alarms - acknowledge all of them
   system.db.runUpdateQuery("UPDATE alarmstatus SET unacknowledged = 0")
```

Example 2:

This code would read a single value from a table and show it to the user an a popup box.

```
lakeLevel = system.db.runScalarQuery("SELECT Level FROM LakeInfo WHERE LakeId='Tahoe'")
system.gui.messageBox("The lake level is: %d feet" % lakeLevel)
```

11.5.15 system.db.runUpdateQuery

Description

Runs a query against a database connection, returning the number of rows affected. Typically this is an UPDATE, INSERT, or DELETE query. If no database is specified, or the database is the empty-string "", then the current project's default database connection will be used.

Note that you may want to use the `runPrepUpdate` query if your query is constructed with user input (to avoid the user's input from breaking your syntax) or if you need to insert binary or BLOB data.

Syntax

```
system.db.runUpdateQuery(query, database, tx, getKey, skipAudit)
```

Parameters

String `query` - A SQL query, usually an INSERT, UPDATE, or DELETE query, to run.

String `database` - The name of the database connection to execute against. If omitted or "", the project's default database connection will be used.

String `tx` - A transaction identifier. If omitted, the update will be executed in its own transaction.

Boolean `getKey` - A flag indicating whether or not the result should be the number of rows returned (getKey=0) or the newly generated key value that was created as a result of the update (getKey=1). Not all databases support automatic retrieval of generated keys.

Boolean `skipAudit` - A flag which, if set to true, will cause the update query to skip the audit system. Useful for some queries that have fields which won't fit into the audit log.

Returns

Integer - The number of rows affected by the query, or the key value that was generated, depending on the value of the getKey flag.

Scope

All

Examples

This code would acknowledge all unacknowledged alarms # and show the user how many alarms

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were acknowledged.

```
rowsChanged = system.db.runUpdateQuery("UPDATE alarmstatus SET unacknowledged = 0")
system.gui.messageBox("Acknowledged %d alarms" % rowsChanged)
```

This code would insert a new recipe step into a recipe table, after asking the user how many gallons of syrup should be added on this recipe step.

```
inputText = system.db.inputBox("How many gallons?", "12.3")
# Make sure the user didn't hit cancel
if inputText != None:
   # Make sure the input is a number
   gallons = float(inputText)
   # Detect the next step number by adding 1 to the last step number
   nextStepNum = system.db.runScalarQuery("SELECT MAX(StepNum) + 1 FROM RecipeSteps")
   # Insert recipe step
   system.db.runUpdateQuery("INSERT INTO RecipeSteps (StepNum, Gallons) VALUES (%d, %f)" % (nex
```

This example inserts a new user and gives it the 'admin' role. Demonstrates the ability to retrieve a newly created key value.

```
#get the username/password
name = event.source.parent.getComponent('Name').text
desc = event.source.parent.getComponent('Description').text
building = event.source.parent.getComponent('Building').selectedValue

#insert the value
id = system.db.runUpdateQuery("INSERT INTO machines (machine_name, description) VALUES ('%s', '

#add a row to the user role mapping table
system.db.runUpdateQuery("INSERT INTO machine_building_mapping (machine_id, building) VALUES (%
```

11.6 system.file

11.6.1 system.file.fileExists

Description

Checks to see if a file at a given path exists.

Syntax

```
system.file.fileExists(filepath)
```

Parameters

String `filepath` - The path of the file to check.

Returns

boolean - True (1) if the file exists, false (0) otherwise.

Scope

All

Examples

This basic example shows how the `fileExists` function is used in its simplest form:

```
if system.file.fileExists("C:\\temp_file.txt"):
   system.gui.messageBox("Yes, the file exists")
```

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```
else:
   system.gui.messageBox("No, it doesn't exist")
```

This code uses the `fileExists` function, along with other `system.file.*` functions, to prompt the user to confirm that they want to overwrite an existing file.

```
filename = system.file.saveFile(name)
if filename != None:
   reallyWrite = 1
   if system.file.fileExists(filename):
      reallyWrite = system.gui.confirm("File '%s' already exists. Overwrite?" % filename)
   if reallyWrite:
      system.file.writeFile(filename, "This will be the contents of my new file")
```

11.6.2 system.file.getTempFile

Description

Creates a new temp file on the host machine with a certain extension, returning the path to the file. The file is marked to be removed when the Java VM exits.

Syntax

```
system.file.getTempFile(extension)
```

Parameters

String `extension` - An extension, like ".txt", to append to the end of the temporary file.

Returns

String - The path to the newly created temp file.

Scope

All

Examples

This code writes some data to a temorary file, and then opens that file. Assume that the data variable holds the contents of an excel (xls) file.

```
filename = system.file.getTempFile("xls")
system.file.writeFile(filename, data)
system.net.openURL("file://" + filename)
```

11.6.3 system.file.openFile

Description

Shows an "Open File" dialog box, prompting the user to choose a file to open. Returns the path to the file that the user chose, or `None` if the user canceled the dialog box. An extension can optionally be passed in that sets the filetype filter to that extension.

Syntax

```
system.file.openFile([extension])
```

Parameters

String `extension` - A file extension, like "pdf", to try to open. [optional]

Returns

String - The path to the selected file, or None if canceled.

Scope

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Client

Examples

This code would prompt the user to open a file of type 'gif'. If None is returned, it means the user canceled the open dialog box.

```
path = system.db.openFile('gif')
if path != None:
   # do something with the file
```

11.6.4 system.file.readFileAsBytes

Description

Opens the file found at path `filename`, and reads the entire file. Returns the file as an array of bytes. Commonly this array of bytes is uploaded to a database table with a column of type BLOB (Binary Large OBject). This upload would be done through an INSERT or UPDATE SQL statement run through the `system.db.runPrepUpdate` function. You could also write the bytes to another file using the `system.file.writeFile` function, or send the bytes as an email attachment using `system.net.sendEmail`.

Syntax

```
system.file.readFileAsBytes(filepath)
```

Parameters

String `filepath` - The path of the file to read.

Returns

byte[] - The contents of the file as an array of bytes.

Scope

All

Examples

This code would prompt the user to choose a file. If the user chooses a file, it would then read that file and upload it to a database table called Files into a BLOB column called file_data.

```
path = system.file.openFile()

if path != None:
   bytes = system.file.readFileAsBytes(filename)
   system.db.runPrepUpdate("INSERT INTO Files (file_data) VALUES (?)", (bytes))
```

11.6.5 system.file.readFileAsString

Description

Opens the file found at path `filename`, and reads the entire file. Returns the file as a string. Common things to do with this string would be to load it into the text property of a component, upload it to a database table, or save it to another file using `system.file.writeFile` function.

Syntax

```
system.file.readFileAsString(filepath)
```

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Parameters

String `filepath` - The path of the file to read.

Returns

String - The contents of the file as a string.

Scope

All

Examples

This code would prompt the user to choose a text file. If the user chooses a file, it would then set a text area on the screen to display the file.

```
path = system.file.openFile("txt")

if path != None:
   contents = system.file.readFileAsString(path)
   event.source.parent.getComponent("Text Area").text = contents
```

11.6.6 system.file.saveFile

Description

Prompts the user to save a new file named `filename`. The optional `extension` and `typeDesc` arguments will be used for a file type filter, if any. If the user accepts the save, the path to that file will be returned. If the user cancels the save, `None` will be returned.

Syntax

```
system.file.saveFile(filename [, extension] [, typeDesc])
```

Parameters

String `filename` - A file name to suggest to the user.

String `extension` - The appropriate file extension, like "jpeg", for the file. [optional]

String `typeDesc` - A description of the extension, ilke "JPEG Image" [optional]

Returns

String - The path to the file that the user decided to save to, or None if they canceled.

Scope

Client

Examples

This code would prompt the user to save the text in a text area to a file.

```
path = system.file.saveFile("myfile.txt")
if path != None:
   system.file.writeFile(path, event.source.parent.getComponent("Text Area").text)
```

11.6.7 system.file.writeFile

Description

Writes the given data to the file at file path `filename`. If the file exists, the `append` argument determines whether or not it is overwritten (the default) or appended to. The data argument can be either a string or an array of bytes (commonly retrieved from a BLOB in a database or read from

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another file using `system.file.readFileAsBytes`).

Syntax

system.file.**writeFile(**filepath, charData **[**, append**])**

Parameters

String `filepath` - The path of the file to write to.
String `charData` - The character content to write to the file.
boolean `append` - If true(1), the file will be appended to if it already exists. If false(0), the file will be overwritten if it exists. The default is false(0). [optional]

Returns

nothing

Scope

All

system.file.**writeFile(**filepath, data **[**, append**])**

Parameters

String `filepath` - The path of the file to write to.
byte[] `data` - The binary content to write to the file.
boolean `append` - If true(1), the file will be appended to if it already exists. If false(0), the file will be overwritten if it exists. The default is false(0). [optional]

Returns

nothing

Scope

All

Examples

Example 1:

This code would download a BLOB from a database and save it to a file.

```
resultset = system.db.runQuery("SELECT file_data FROM Files WHERE id=12")
   if len(rs) > 0: # if the query returned anything...
      data = rs[0][0] # grab the BLOB at the 0th row and 0th column
      filename = system.file.saveFile("MyDownloadedFile.xyz")
      if filename != None:
         system.file.writeFile(filename, data)
```

Example 2:

This code would write the contents of a text area to a file.

```
data = event.source.parent.getComponent("Text Area").text
filename = system.file.saveFile("MyDownloadedFile.txt")
if filename != None:
   system.file.writeFile(filename, data)
```

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11.7 system.gui

11.7.1 system.gui.chooseColor

Description

Prompts the user to pick a color using the default color-chooser dialog box.

Syntax

```
system.gui.chooseColor(initialColor [, dialogTitle])
```

Parameters

Color `initialColor` - A color to use as a starting point in the color choosing popup.
String `dialogTitle` - The title for the color choosing popup. Defaults to "Choose Color" [optional]

Returns

Color - The new color chosen by the user.

Scope

Client

Examples

This code would be placed in the actionPerformed event of a button, and would change the background color of the container the button was placed in.

```
parent = event.source.parent
newColor = system.gui.chooseColor(parent.background)
parent.background = newColor
```

11.7.2 system.gui.color

Description

Creates a new color object, either by parsing a string or by having the RGB[A] channels specified explicitly.

Syntax

```
system.gui.color(color)
```

Parameters

String `color` - A string that will be coerced into a color. Can accept many formats, such as "red" or "#FF0000" or "255,0,0"

Returns

Color - The newly created color.

Scope

Client

```
system.gui.color(red, green, blue [, alpha])
```

Parameters

int `red` - The red component of the color, an integer 0-255.
int `green` - The green component of the color, an integer 0-255.

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int `blue` - The blue component of the color, an integer 0-255.
int `alpha` - The alpha component of the color, an integer 0-255. [optional]

Returns
Color - The newly created color.

Scope
Client

Examples
This example changes the background color of a component to red.

```
myComponent = event.source
myComponent.background = fpmi.gui.color(255,0,0) # turn the component red
```

11.7.3 system.gui.confirm

Description
Displays a confirmation dialog box to the user with "Yes" and "No" options, and a custom message.

Syntax

```
system.gui.confirm(message [, title])
```

Parameters
String `message` - The message to show in the confirmation dialog.
String `title` - The title for the confirmation dialog. [optional]

Returns
boolean - True (1) if the user selected "Yes", false (0) if the user selected "No"

Scope
Client

Examples
By using the confirm function in an if statement, we can let the user confirm an action. In this case, we shut down the plaint if the user confirms it, otherwise, we don't do anything.

```
if system.gui.confirm("Are you sure you want to shutdown the plant?", "Really Shutdown?"):
   system.db.runUpdateQuery("UPDATE ControlTable SET Shutdown=1")
```

11.7.4 system.gui.convertPointToScreen

Description
Converts a pair of coordinates that are relative to the upper-left corner of some component to be relative to the upper-left corner of the entire screen.

Syntax

```
system.gui.convertPointToScreen(x, y, event)
```

Parameters
int `x` - The X-coordinate, relative to the component that fired the event.
int `y` - The Y-coordinate, relative to the component that fired the event.
EventObject `event` - An event object for a component event.

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Returns
PyTuple - A tuple of (x,y) in screen coordinates.

Scope
Client

Examples

This example will get the coordinates where the mouse is (from the corner of the monitor) and display them in a label.

```
#get the screen coordinates of the pointer and write them to a label
coords = system.gui.convertPointToScreen(event.x,event.y,event)
event.source.parent.getComponent('Label').text = "x: %s y: %s" %(coords[0], coords[1])
```

11.7.5 system.gui.createPopupMenu

Description

Creates a new popup menu, which can then be shown over a component on a mouse event.

To use this function, first create a Python sequence whose entries are strings, and another sequence whose entries are *function objects*. The strings will be the items that are displayed in your popup menu, and when an item is clicked, its corresponding function will be run. Your functions must accept an `event` object as an argument. See also: Functions

To show the popup menu, store the menu object that this function returns, and then call its `show(event)` function, where `event` is the event object for a `mousePressed` or `mouseReleased` event on the component you wish the popup menu to be shown on.

Best Practices. It is best to have the menu object created only once via an application specific library function. Then, call the `show(event)` function on *both* the `mousePressed` and `mouseReleased` events on your component. The reason for this is that different operating systems (Windows, Linux, MacOS) differ in when they like to show the popup menu. The `show(event)` function detects when the right time is to show itself, either on mouse press or release. See the examples for more.

Syntax

```
system.gui.createPopupMenu(itemsDict)
```

Parameters
PyDictionary `itemsDict` - A dictionary of String:Function keys to create the popup menu. You can create sub-menus by using a nested dictionary of the same type as a dictionary value.

Returns
JPopupMenu - The javax.swing.JPopupMenu that was created.

Scope
Client

```
system.gui.createPopupMenu(itemNames, itemFunctions)
```

Parameters
PySequence `itemNames` - A list of names to create popup menu items with.
PySequence `itemFunctions` - A list of functions to match up with the names.

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Returns

JPopupMenu - The javax.swing.JPopupMenu that was created.

Scope

Client

Examples

This first example is a very basic to demonstrate the fundamentals of making a popup menu. Put the following script in the `mouseReleased` event of a component. This will only work on Windows - continue on for cross-platform instructions.

```
def sayHello(event):
    import system
    system.gui.messageBox("Hello World")

menu = system.gui.createPopupMenu({"Click Me":sayHello})

menu.show(event)
```

Because of the different popup-trigger settings on different operating systems, the preceding code will probably fail on Linux or a Mac. The way around this is to do the same code in both the `mousePressed` and `mouseReleased` events. In order to avoid code duplication, you'll want to factor out the code into a project script module.

The following, more sophisticated example shows a popup menu being used to acknowledge alarms in an alarm table by right-clicking on the table, and choosing either to acknowledge the selected alarm or all alarms. You would put this script in a project script module called `app.util`:

```
def getAlarmPopup():
    import system,app

    # This function will be the "Acknowledge" entry in the popup menu
    def ack(event):
        import system,app
        table = event.source
        selRow = table.selectedRow
        if selRow == -1:
            system.gui.warningBox("No alarm selected")
        elif table.model.getValueAt(selRow, 0) == 0:
            # In my table, the first column is the alarm's unacknowledged bit.
            system.gui.warningBox("Alarm already acknowledged")
        else:
            desc = table.model.getValueAt(selRow, 1)
            path = table.model.getValueAt(selRow, 2)
            message = "<html>Are you sure you want to acknowledge<br>%s?" % desc
            if system.gui.confirm(message,"Confirm"):
                app.auth.ackAlarm(desc,path)
                table.setSelectedRow(-1)

    # This function will be the "Acknowledge All" entry in the popup menu
    def ackAll(event):
        import system,app
        if system.gui.confirm("Are you sure you want to acknowledge all alarms?","Confirm"):
            app.auth.ackAllAlarms(event)

    # Finally, create the actual popup menu and return it
    alarmPopup = system.gui.createPopupMenu(["Acknowledge Alarm", "Acknowledge All"],[ack, ackAl
    return alarmPopup
```

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Now you could simply put this code in the Table's `mousePressed` and `mouseReleased` events:

```
menu = app.util.getAlarmPopup()
menu.show(event)
```

11.7.6 system.gui.errorBox

Description

Displays an error-style message box to the user.

Syntax

```
system.gui.errorBox(message [, title])
```

Parameters

String `message` - The message to display in an error box.
String `title` - The title for the error box. [optional]

Returns

nothing

Scope

Client

Examples

Turn on compressor #12, but only if the user has the right credentials.

```
if 'Supervisor' in system.security.getRoles():
    system.db.runUpdateQuery("UPDATE CompressorControl SET running=1 WHERE compNum = 12")
else:
    system.gui.errorBox("Unable to turn on Compressor 12. You don't have proper security privil
```

See also:
system.gui.messageBox
system.gui.warningBox

11.7.7 system.gui.findWindow

Description

Finds and returns a list of windows with the given path. If the window is not open, an empty list will be returned. Useful for finding all instances of an open window that were opened with `system.gui.openWindowInstance`

Syntax

```
system.gui.findWindow(path)
```

Parameters

String `path` - The path of the window to search for

Returns

List - A list of window objects. May be empty if window is not open, or have more than one entry if multiple windows are open.

Scope

Client

Examples

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This example finds all of the open instances of the window named "Popup" and closes them all.

```
allInstances = system.gui.findWindow("Popup")
for window in allInstances:
    system.nav.closeWindow(window)
```

11.7.8 system.gui.getOpenedWindowNames

Description

Finds all of the currently open windows, returning a tuple of their paths.

Syntax

```
system.gui.getOpenedWindowNames()
```

Parameters

none

Returns

PyTuple - A tuple of strings, representing the path of each window that is open.

Scope

Client

Examples

This example prints out into the console the full path for each opened window.

```
windows = system.gui.getOpenedWindowNames()
print 'There are %d windows open' % len(windows)
for path in windows:
    print path
```

11.7.9 system.gui.getOpenedWindows

Description

Finds all of the currently open windows, returning a tuple of references to them.

Syntax

```
system.gui.getOpenedWindows()
```

Parameters

none

Returns

PyTuple - A tuple of the opened windows. Not their names, but the actual window objects themselves.

Scope

Client

Examples

This example prints out the path of each currently opened window to the console.

```
windows = system.gui.getOpenedWindows()
print 'There are %d windows open' % len(windows)
for window in windows:
    print window.getPath()
```

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11.7.10 system.gui.getParentWindow

Description

Finds the parent (enclosing) window for the component that fired an event, returning a reference to it.

Syntax

```
system.gui.getParentWindow(event)
```

Parameters

EventObject `event` - A component event object.

Returns

PyObject - The window that contains the component that fired the event.

Scope

Client

Examples

Use this in an event script to change the window's title.

```
window = system.gui.getParentWindow(event)
window.title='This is a new title'
```

11.7.11 system.gui.getSibling

Description

Given a component event object, looks up a sibling component. Shortcut for `event.source.parent.getComponent("siblingName")`. If no such sibling is found, the special value `None` is returned.

Syntax

```
system.gui.getSibling(event, name)
```

Parameters

EventObject `event` - A component event object.

String `name` - The name of the sibling component.

Returns

PyObject - The sibling component itself.

Scope

Client

Examples

This example will get it's sibling Text Field's text, and use it.

```
textField = system.gui.getSibling(event, 'TextField (1)')
if textField is None:
   system.gui.errorBox("There is no text field!")
else:
   system.gui.messageBox("You typed: %s" % textField.text)
```

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11.7.12 system.gui.getWindow

Description

Finds a reference to an open window with the given name. Throws a `ValueError` if the named window is not open or not found.

Syntax

```
system.gui.getWindow(name)
```

Parameters

String `name` - The path to the window to field.

Returns

PyObject - A reference to the window, if it was open.

Scope

Client

Examples

Example 1:

This example will get the window named 'Overview' and then close it.

```
try:
   window = system.gui.getWindow('Overview')
   system.gui.closeWindow(window)

except ValueError:
   system.gui.warningBox("The Overview window isn't open")
```

Example 2:

This example will set a value on a label component in the 'Header' window.

```
try:
   window = system.gui.getWindow('Header')
   window.getRootContainer().getComponent('Label').text = "Machine 1 Starting"

except ValueError:
   system.gui.warningBox("The Header window isn't open")
```

11.7.13 system.gui.getWindowNames

Description

Returns a list of the paths of all windows in the current project, sorted alphabetically.

Syntax

```
system.gui.getWindowNames()
```

Parameters

none

Returns

PyTuple - A tuple of strings, representing the path of each window defined in the current project.

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Scope
Client

Examples

This example would open windows that begin with "Motor" and pass in the currently selected motor number.

```
motor = event.source.parent.number
windows = system.gui.getWindowNames()
for path in windows:
   if name[:5] == "Motor":
      system.gui.openWindow(path, {"motorNumber":motor})
```

11.7.14 system.gui.inputBox

Description

Opens up a popup input dialog box. This dialog box will show a prompt message, and allow the user to type in a string. When the user is done, they can press "OK" or "Cancel". If OK is pressed, this function will return with the value that they typed in. If Cancel is pressed, this function will return the value `None`.

Syntax

```
system.gui.inputBox(message, defaultText)
```

Parameters
String `message` - The message to display for the input box.
String `defaultText` - The default text to initialize the input box with.

Returns
String - The string value that was entered in the input box.

Scope
Client

Examples

This could go in the `mouseClicked` event of a label to allow the user to change the label's text.

```
txt = system.gui.inputBox("Enter text:", event.source.text)
if txt != None:
   event.source.text = txt
```

11.7.15 system.gui.isTouchscreenModeEnabled

Description

Checks whether or not the running client's touchscreen mode is currently enabled.

Syntax

```
system.gui.isTouchscreenModeEnabled()
```

Parameters
none

Returns

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boolean - True(1) if the client currently has touchscreen mode activated.

Scope
Client

Examples

This example should be used in the Client Startup Script to check if this client is being run on a touch screen computer (judged by an IP address) and set touchscreen mode.

```
ipAddress = system.net.getIpAddress()
isTouchscreen = system.db.runScalarQuery("SELECT COUNT(*) FROM touchscreen_computer_ips WHERE i
if isTouchscreen and not system.gui.isTouchscreenModeEnabled():
   system.gui.setTouchscreenModeEnabled(1)
```

See also:
system.gui.setTouchscreenModeEnabled

11.7.16 system.gui.messageBox

Description

Displays an informational-style message popup box to the user.

Syntax

```
system.gui.messageBox(message [, title])
```

Parameters
String `message` - The message to display.
String `title` - A title for the message box. [optional]

Returns
nothing

Scope
Client

Examples

This example will show how many hours a motor has been running when it is clicked.

```
# get the motor number
motorNumber = event.source.getPropertyValue('MotorNumber')
# retrieve the hours running from the database
hours = system.db.runScalarQuery("SELECT HoursRunning FROM MotorStatus WHERE motor=%d" % motorN

system.gui.messageBox("The motor has been running for %d hours" % motorNumber)
```

See also:
system.gui.warningBox
system.gui.errorBox

11.7.17 system.gui.moveComponent

Description

Alter's a components position to a new pair of coordinates, (x,y), a point relative to the upper-left corner of the component's parent. Note that when using relative layout, these coordinates are evaluated as if the component's size was the same size as the last time the component was saved in

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the Designer. This effectively means that your argument coordinates will automatically scale with relative layout.

Syntax

```
system.gui.moveComponent(component, x, y)
```

Parameters

JComponent `component` - The component to move.
int `x` - The x-coordinate to move to, relative to the upper-left corner of the component's parent container.
int `y` - The y-coordinate to move to, relative to the upper-left corner of the component's parent container.

Returns

nothing

Scope

Client

Examples

This code would go in a Timer's `propertyChange` script for animation.

```
if event.propertyName == "value":
   newX = event.newValue;
   rect = event.source.parent.getComponent("Rectangle")
   system.gui.moveComponent(rect, newX, 250)
```

See also:
system.gui.reshapeComponent
system.gui.resizeComponent

11.7.18 system.gui.passwordBox

Description

Pops up a special input box that uses a password field, so the text isn't echoed back in clear-text to the user. Returns the text they entered, or `None` if they canceled the dialog box.

Syntax

```
system.gui.passwordBox(message [, title] [, echoChar])
```

Parameters

String `message` - The message for the password prompt.
String `title` - A title for the password prompt. [optional]
String `echoChar` - A custom echo character. Defaults to: * [optional]

Returns

String - The password that was entered, or None if the prompt was canceled.

Scope

Client

Examples

This example would prompt a user for a password before opening the 'Admin' Screen.

```
password = system.gui.passwordBox("Please enter the password.")
```

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```
if password == "open sesame":
   system.nav.openWindow("Admin")
```

11.7.19 system.gui.reshapeComponent

Description

Sets a component's position and size at runtime. The coordinates work in the same way as the `system.gui.moveComponent` function.

Syntax

```
system.gui.reshapeComponent(component, x, y, width, height)
```

Parameters

JComponent `component` - The component to move and resize
int `x` - The x-coordinate to move to, relative to the upper-left corner of the component's parent container.
int `y` - The y-coordinate to move to, relative to the upper-left corner of the component's parent container.
int `width` - The new width for the component
int `height` - The new height for the component

Returns

nothing

Scope

Client

Examples

This code would go in a Timer's `propertyChange` script for animation.

```
if event.propertyName == "value":
   newX = event.newValue;
   newWidth = int(event.newValue*1.5)
   rect = event.source.parent.getComponent("Rectangle")
   system.gui.reshapeComponent(rect, newX, 150, newWidth, 80)
```

See also:
system.gui.resizeComponent
system.gui.moveComponent

11.7.20 system.gui.resizeComponent

Description

Sets a component's size at runtime. The coordinates work in the same way as the `system.gui.moveComponent` function.

Syntax

```
system.gui.resizeComponent(component, width, height)
```

Parameters

JComponent `component` - The component to resize
int `width` - The new width for the component

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int `height` - The new height for the component

Returns
nothing

Scope
Client

Examples

This code would go in a Timer's propertyChange script for animation \

```
if event.propertyName == "value":
   newWidth = event.newValue;
   rect = event.source.parent.getComponent("Rectangle")
   system.gui.resizeComponent(newWidth, 80)
```

See also:
system.gui.reshapeComponent
system.gui.moveComponent

11.7.21 system.gui.setTouchscreenModeEnabled

Description

Alters a running client's touchscreen mode on the fly.

Syntax

```
system.gui.setTouchscreenModeEnabled(enabled)
```

Parameters
boolean `enabled` - The new value for touchscreen mode being enabled.

Returns
nothing

Scope
Client

Examples

This example could be used on an input heavy window's internalFrameActivated event to remove touch screen mode.

```
if system.gui.isTouchscreenModeEnabled():
   system.gui.setTouchscreenModeEnabled(0)
```

See also:
system.gui.isTouchscreenModeEnabled

11.7.22 system.gui.showNumericKeypad

Description

Displays a modal on-screen numeric keypad, allowing for arbitrary numeric entry using the mouse, or a finger on a touchscreen monitor. Returns the number that the user entered.

Syntax

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system.gui.**showNumericKeypad(**initialValue **[**, fontSize**])**

Parameters

Number `initialValue` - The value to start the on-screen keypad with.

int `fontSize` - The font size to display in the keypad. [optional]

Returns

Number - The value that was entered in the keypad.

Scope

Client

Examples

This function is a holdover for backwards compatibility. Input components now know when the client is in touchscreen mode and respond accordingly. This script would go in the MouseClicked or MousePressed action of a Text Field or Numeric Text Field.

```
# For Integer Numeric Text Field:
if system.gui.isTouchscreenModeEnabled():
   event.source.intValue = system.gui.showNumericKeypad(event.source.intValue)

# For Double Numeric Text Field:
if system.gui.isTouchscreenModeEnabled():
   event.source.doubleValue = system.gui.showNumericKeypad(event.source.doubleValue)

# For Text Field:
# notice the str() and int() functions used to convert the text to a number and vice versa
# str() and int() are built-in Jython functions
if system.gui.isTouchscreenModeEnabled():
   event.source.text = str(system.gui.showNumericKeypad(int(event.source.text)))
```

11.7.23 system.gui.showTouchscreenKeyboard

Description

Displays a modal on-screen keyboard, allowing for arbitrary text entry using the mouse, or a finger on a touchscreen monitor. Returns the text that the user "typed".

Syntax

system.gui.**showTouchscreenKeyboard(**initialText **[**, fontSize**] [**, passwordMode**])**

Parameters

String `initialText` - The text to start the on-screen keyboard with.

int `fontSize` - The font size to display in the keyboard. [optional]

boolean `passwordMode` - True (1) to activate passwordmode, where the text entered isn't echoed back clear-text. [optional]

Returns

String - The text that was "typed" in the on-screen keyboard.

Scope

Client

Examples

This function is a holdover for backwards compatibility. Input components now know when the client is in touchscreen mode and respond accordingly. This would go in the MouseClicked or

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MousePressed action of a Text Field or similar component.

```
if system.gui.isTouchscreenModeEnabled():
   event.source.text = system.gui.showTouchscreenKeyboard(event.source.text)
```

11.7.24 system.gui.warningBox

Description

Displays a message to the user in a warning style pop-up dialog.

Syntax

```
system.gui.warningBox(message [, title])
```

Parameters

String `message` - The message to display in the warning box.
String `title` - The title for the warning box. [optional]

Returns

nothing

Scope

Client

Examples

This code show a yellow popup box similar to the system.gui.messageBox function.

```
# Start the motor, or, warn the user if in wrong mode
runMode = event.source.parent.getPropertyValue('RunMode')
if runMode == 1: Cannot start the motor in mode #1
   system.gui.warningBox("Cannot start the motor, current mode is <B>VIEW MODE</B>")
else:
   system.db.runUpdateQuery("UPDATE MotorControl SET MotorRun=1")
```

See also:
system.gui.messageBox
system.gui.errorBox

11.8 system.nav

11.8.1 system.nav.centerWindow

Description

Given a window path, or a reference to a window itself, it will center the window. The window should be floating an non-maximized. If the window can't be found, this function will do nothing.

Syntax

```
system.nav.centerWindow(windowPath)
```

Parameters

String `windowPath` - The path of the window to center.

Returns

nothing

Scope

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Client

```
system.nav.centerWindow(window)
```

Parameters

FPMIWindow `window` - A reference to the window to center.

Returns

nothing

Scope

Client

Examples

```
#This example centers the window named 'Overview'.
system.nav.centerWindow('Overview')
```

See also:
system.nav.openWindow

11.8.2 system.nav.closeParentWindow

Description

Closes the parent window given a component event object.

Syntax

```
system.nav.closeParentWindow(event)
```

Parameters

EventObject `event` - A component event object. The enclosing window for the component will be closed.

Returns

nothing

Scope

Client

Examples

```
#This code would be placed in the actionPerformed event of a button, and would close the window
system.nav.closeParentWindow(event)
```

11.8.3 system.nav.closeWindow

Description

Given a window path, or a reference to a window itself, it will close the window. If the window can't be found, this function will do nothing.

Syntax

```
system.nav.closeWindow(windowPath)
```

Parameters

String `windowPath` - The path of a window to close.

Returns

nothing

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Scope
Client

```
system.nav.closeWindow(window)
```

Parameters
FPMIWindow `window` - A reference to the window to close.

Returns
nothing

Scope
Client

Examples

Example 1:

This example would get the window named 'Overview' and then close it.

```
# If the window isn't open, show a warning
try:
   window = system.gui.getWindow('Overview')
   system.nav.closeWindow(window)
except ValueError:
   system.gui.warningBox("The Overview window isn't open")
```

Example 2:

This example would close the window named 'Overview' in one step.

```
# If the window isn't open, the call to closeWindow will have no effect
system.nav.closeWindow('Overview')
```

11.8.4 system.nav.getCurrentWindow

Description

Returns the path of the current "main screen" window, which is defined as the maximized window. With the Typical Navigation Strategy, there is only ever one maximized window at a time.

Syntax

```
system.nav.getCurrentWindow()
```

Parameters
none

Returns
String - The path of the current "main screen" window - the maximized window.

Scope
Client

Examples

```
# This code could run in a global timer script.
# After a 5-minute timeout, navigate back to the home screen
if system.util.getInactivitySeconds() > 300 and system.nav.getCurrentWindow() != "HomeScreen":
   system.nav.swapTo("HomeScreen")
```

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11.8.5 system.nav.goBack

Description

When using the Typical Navigation Strategy, this function will navigate back to the previous main screen window.

Syntax

```
system.nav.goBack()
```

Parameters

none

Returns

PyObject - The window that was returned to

Scope

Client

Examples

This code would go in a button to move to the previous screen.

```
system.nav.goBack()
```

11.8.6 system.nav.goForward

Description

When using the Typical Navigation Strategy, this function will navigate "forward" to the last main-screen window the user was on when they executed a `system.nav.goBack()`.

Syntax

```
system.nav.goForward()
```

Parameters

none

Returns

PyObject - The window that was returned to

Scope

Client

Examples

This code would go in a button to move to the last screen that used system.nav.goBack().

```
system.nav.goForward()
```

11.8.7 system.nav.goHome

Description

When using the Typical Navigation Strategy, this function will navigate to the "home" window. This is automatically detected as the first main-screen window shown in a project.

Syntax

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system.nav.**goHome()**

Parameters

none

Returns

PyObject - A reference to the home window that was navigated to.

Scope

Client

Examples

This code would go in a button to move to the Home screen.

```
system.nav.goHome()
```

11.8.8 system.nav.openWindow

Description

Opens the window with the given path. If the window is already open, brings it to the front. The optional `params` dictionary contains key:value pairs which will be used to set the target window's root container's dynamic variables.

For instance, if the window that you are opening is named "TankDisplay" has a dynamic variable in its root container named "TankNumber", then calling `system.nav.openWindow ("TankDisplay", {"TankNumber" : 4})` will open the "TankDisplay" window and set `Root Container.TankNumber` to four. This is useful for making parameterized windows, that is, windows that are re-used to display information about like pieces of equipment. See also: Parameterized Windows.

Syntax

system.nav.**openWindow(**path **[**, params**])**

Parameters

String `path` - The path to the window to open.

PyDictionary `params` - A dictionary of parameters to pass into the window. The keys in the dictionary must match dynamic property names on the target window's root container. The values for each key will be used to set those properties. [optional]

Returns

PyObject - A reference to the opened window.

Scope

Client

Examples

Example 1:

```
# This is the simplest form of openWindow
system.nav.openWindow("SomeWindowName")
```

Example 2:

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```
# A more complex example - a setpoint screen for multiple valves that opens centered
titleText = "Third Valve Setpoints"
tankNo = system.nav.openWindow("ValveSetPts", {"valveNum":3, "titleText":titleText})
system.nav.centerWindow("ValveSetPts")
```

11.8.9 system.nav.openWindowInstance

Description

Operates exactly like system.nav.openWindow, except that if the named window is already open, then an *additional instance* of the window will be opened. There is no limit to the number of additional instances of a window that you can open.

Syntax

```
system.nav.openWindowInstance(path [, params])
```

Parameters

String `path` - The path to the window to open.

PyDictionary `params` - A dictionary of parameters to pass into the window. The keys in the dictionary must match dynamic property names on the target window's root container. The values for each key will be used to set those properties. [optional]

Returns

PyObject - A reference to the opened window.

Scope

Client

Examples

This example would open three copies of a single HOA popup screen.

```
system.nav.openWindowInstance("HOA" {machineNum:3})
system.nav.openWindowInstance("HOA" {machineNum:4})
system.nav.openWindowInstance("HOA" {machineNum:5})
```

11.8.10 system.nav.swapTo

Description

Performs a window swap from the current *main screen* window to the window specified. Swapping means that the opened window will take the place of the closing window - in this case it will be maximized. See also: Typical Navigation Strategy.

Syntax

```
system.nav.swapTo(path [, params])
```

Parameters

String `path` - The path of a window to swap to.

PyDictionary `params` - A dictionary of parameters to pass into the window. The keys in the dictionary must match dynamic property names on the target window's root container. The values for each key will be used to set those properties. [optional]

Returns

PyObject - A reference to the swapped-to window.

Scope

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Client

Examples

Example 1:

This code would go in a button's ActionPerformed event to swap out of the current window and into a window named MyWindow

```
system.nav.swapTo("MyWindow")
```

Example 2:

This code would go in a button's ActionPerformed event to swap out of the current window and into a window named MyWindow. It also looks at the selected value in a dropdown menu and passes that value into the new window.

```
# MyWindow's Root Container must have a dynamic property named "paramValue"
dropdown = event.source.parent.getComponent("Dropdown")
system.nav.swapTo("MyWindow", {"paramValue":dropdown.selectedValue)
```

See also:
system.nav.swapWindow

11.8.11 system.nav.swapWindow

Description

Performs a window *swap*. This means that one window is closed, and another is opened and takes its place - assuming its size, floating state, and maximization state. This gives a seamless transition - one window seems to simply turn into another.

Syntax

```
system.nav.swapWindow(swapFromPath, swapToPath [, params])
```

Parameters

String `swapFromPath` - The path of the window to swap from. Must be a currently open window, or this will act like an openWindow.

String `swapToPath` - The name of the window to swap to.

PyDictionary `params` - A dictionary of parameters to pass into the window. The keys in the dictionary must match dynamic property names on the target window's root container. The values for each key will be used to set those properties. [optional]

Returns

PyObject - A reference to the swapped-to window.

Scope

Client

```
system.nav.swapWindow(event, swapToPath [, params])
```

Parameters

EventObject `event` - A component event whose enclosing window will be used as the "swap-from" window.

String `swapToPath` - The name of the window to swap to.

PyDictionary `params` - A dictionary of parameters to pass into the window. The keys in the

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dictionary must match dynamic property names on the target window's root container. The values for each key will be used to set those properties. [optional]

Returns
PyObject - A reference to the swapped-to window.

Scope
Client

Examples

This function works like system.nav.swapTo except that you can specify the source and destination for the swap.

Example 1:

```
# This code would go in a button's ActionPerformed event to swap out of the
# window containing the button and into a window named MyWindow
system.nav.swapWindow(event, "MyWindow")
```

Example 2:

```
# This code would swap from window named WindowA to a window named WindowB
system.nav.swapWindow("WindowA", "WindowB")
```

Example 3:

```
# This code would swap from window named WindowA to a window named WindowB.
# It also looks at the two calendar popup controls and passes the two selected dates to
# WindowB. WindowB's Root Container must have dynamic properties named "startDate" and
# "endDate"
date1 = event.source.parent.getComponent("Start Date").date
date2 = event.source.parent.getComponent("End Date").date
system.nav.swapWindow("WindowA", "WindowB", {"startDate":date1, "endDate":date2})
```

See also:
system.nav.swapTo

11.9 system.net

11.9.1 system.net.getExternalIpAddress

Description

Returns the client's IP address, *as it is detected by the Gateway*. This means that this call will communicate with the Gateway, and the Gateway will tell the clienth what IP address its incoming traffic is coming from. If you have a client behind a NAT router, then this address will be the WAN address of the router instead of the LAN address of the client, which is what you'd get with `system.net.getIpAddress`.

Syntax

```
system.net.getExternalIpAddress()
```

Parameters
none

Returns

String - A text representation of the client's IP address, as detected by the Gateway

Scope
Client

Examples

Put this script on a navigation button to restrict users from opening a specific page.

```
ip = sytem.net.getExternalIpAddress()
#check if this matches the CEO's IP address
if ip == "66.102.7.104":
   system.nav.swapTo("CEO Dashboard")
else:
   system.nav.swapTo("Manager Dashboard")
```

See also:
system.net.getHostName
system.net.getIpAddress

11.9.2 system.net.getHostName

Description

Returns the host name of the computer that the client is currently running on. On Windows, this is typically the "computer name". For example, might return `EAST_WING_WORKSTATION` or `bobs-laptop`.

Syntax

```
system.net.getHostName()
```

Parameters
none

Returns
String - The hostname of the local machine. This is the computer that the script is being executed on - may be a Client or the Gateway depending on the script context.

Scope
All

Examples

Put this script on a navigation button to link dedicated machines to specific screens.

```
comp = sytem.net.getHostName()
#check which line this client is tied to
if comp == "Line1Computer":
   system.nav.swapTo("Line Detail", {"line":1})
elif comp == "Line2Computer":
   system.nav.swapTo("Line Detail", {"line":2})
else:
   system.nav.swapTo("Line Overview")
```

See also:
system.net.getExternalIpAddress
system.net.getIpAddress

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11.9.3 system.net.getIpAddress

Description

Returns the IP address of the computer the client is running on, as it appears to the client. See also: `system.net.getExternalIpAddress()`.

Syntax

system.net.**`getIpAddress()`**

Parameters

none

Returns

String - Returns the IP address of the local machine, as it sees it.

Scope

All

Examples

Put this script on a navigation button to link dedicated machines to specific screens.

```
ip = sytem.net.getIpAddress()
#check which line this client is tied to
if ip == "10.1.10.5":
   system.nav.swapTo("Line Detail", {"line":1})
elif ip == "10.1.10.6":
   system.nav.swapTo("Line Detail", {"line":2})
else:
   system.nav.swapTo("Line Overview")
```

See also:
system.net.getExternalIpAddress
system.net.getHostName

11.9.4 system.net.httpGet

Description

Retrieves the document at the given URL using the HTTP GET protocol. The document is returned as a string. For example, if you use the URL of a website, you'll get the same thing you'd get by going to that website in a browser and using the browser's "View Source" function.

Syntax

system.net.**`httpGet(`**url, connectTimeout, readTimeout**`)`**

Parameters

String `url` - The URL to retrieve.
Integer `connectTimeout` - The timeout for connecting to the url. In millis. Default is 10,000.
Integer `readTimeout` - The read timeout for the get operation. In millis. Default is 60,000.

Returns

String - The content found at the given URL.

Scope

All

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Examples

Example 1:

```
# This code would return the source for Google's homepage
source = system.net.httpGet("http://www.google.com")
print source
```

Example 2:

```
# This code would query Yahoo Weather for the temperature in Sacramento, CA
# and then find the current temperature using a regular expression

response = system.net.httpGet("http://xml.weather.yahoo.com/forecastrss?p=95818")

# import Python's regular expression library
import re

# NOTE - if you've never seen regular expressions before, don't worry, they look
# confusing even to people who use them frequently.
pattern = re.compile('.*?<yweather:condition (.*?)/>', re.DOTALL)
match = pattern.match(response)
if match:
   subText = match.group(1)
   condition = re.compile('.*?text="(.*?)"').match(subText).group(1)
   temp = re.compile('.*?temp="(.*?)"').match(subText).group(1)
   print "Condition: ", condition
   print "Temperature (F): ", temp
else:
   print 'Weather service format changed'
```

11.9.5 system.net.httpPost

Description

Retrieves the document at the given URL using the HTTP POST protocol. If a parameter dictionary argument is specified, the entries in the dictionary will encoded in "application/x-www-form-urlencoded" format, and then posted. You can post arbitrary data as well, but you'll need to specify the MIME type. The document is then returned as a string.

Syntax

system.net.**httpPost(**url, postParams**)**

Parameters

String `url` - The URL to post to.
PyDictionary `postParams` - A dictionary of name: value key pairs to use as the post data.

Returns

String - The content returned for the POST operation.

Scope

All

system.net.**httpPost(**url, contentType, postData**)**

Parameters

String `url` - The URL to post to.

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String `contentType` - The MIME type to use in the HTTP "Content-type" header.
String `postData` - The raw data to post via HTTP.

Returns
String - The content returned for the POST operation.

Scope
All

Examples
Example 1:

```
# This code posts a name (first and last) to the post testing page at
# "http://www.snee.com/xml/crud/posttest.cgi", and returns the resulting page as a string.
page = system.net.httpPost("http://www.snee.com/xml/crud/posttest.cgi", {"fname":"Billy", "lnam
print page
```

Example 2:

```
# This code sends an XML message to a hypothetical URL.
message = "<MyMessage><MyElement>here is the element</MyElement></MyMessage>"
system.net.httpPost("http://www.posttome.xyz/posthere", "text/xml", message)
```

11.9.6 system.net.openURL

Description
Opens the given URL outside of the currently running Client in whatever application the host operating system deems appropriate. For example, the URL:
`"http://www.google.com"`
... will open in the default web browser, whereas this one:
`"file://C:\Report.pdf"`
... will likely open in Adobe Acrobat. The Windows network-share style path like:
`"\\Fileserver\resources\machine_manual.pdf"`
... will work as well (in Windows).

Be careful not to use this function in a full-screen client, as launching an external program will break your full-screen exclusive mode.

Syntax

```
system.net.openURL(url [, useApplet])
```

Parameters
String `url` - The URL to open in a web browser.
boolean `useApplet` - If set to true (1), and the client is running as an Applet, then the browser instance that launched the applet will be used to open the URL. [optional]

Returns
nothing

Scope
Client

Examples
Example 1:

```
# This code would open a web page
system.net.openURL("http://www.google.com")
```

Example 2:

```
# This code would open a PDF document from a Windows-based file server
# Note the double backslashes are needed because backslash is the escape character for Jython
system.net.openURL("\\\\MyServer\\MyDocs\\document.pdf")
```

11.9.7 system.net.sendEmail

Description

Sends an email through the given SMTP server. Note that this email is relayed first through the Gateway - the client host machine doesn't need network access to the SMTP server.

You can send text messages to cell phones and pagers using email. Contact your cell carrier for details. If you had a Verizon cell phone with phone number (123) 555-8383, for example, your text messaging email address would be: 1235558383@vtext.com. Try it out!

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

```
system.net.sendEmail(smtp, fromAddr, subject, body, html, to, attachmentNames, attachmentData, timeout, username, password)
```

Parameters

String `smtp` - The address of an SMTP server to send the email through, like "mail.example.com"
String `fromAddr`
String `subject` - The subject line for the email
String `body` - The body text of the email.
Boolean `html` - A flag indicating whether or not to send the email as an HTML email. Will auto-detect if omitted.
String[] `to` - A list of email addresses to send to.
String[] `attachmentNames` - A list of attachment names.
byte[][] `attachmentData` - A list of attachment data, in binary format.
Integer `timeout` - A timeout for the email, specified in milliseconds. Defaults to 5 minutes (60,000*5)
String `username` - If specified, will be used to authenticate with the SMTP host.
String `password` - If specified, will be used to authenticate with the SMTP host.

Returns

nothing

Scope

All

Examples

Example 1:

```
# This code would send a simple plain-text email to a single recipient, with no attachments
body = "Hello, this is an email."
```

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```
recipients = ["bobsmith@mycompany.com"]
system.net.sendEmail("mail.mycompany.com", "myemail@mycompany.com", "Here is the email!", body,
```

Example 2:

```
# This code would send an HTML-formatted email to multiple recipients (including cellphones) wi
body = "<HTML><BODY><H1>This is a big header</H1>And this text is <font color='red'>red</font><
recipients = ["bobsmith@mycompany.com", "1235558383@vtext.com", "sally@acme.org", "1235557272@v
myuser = "mycompany"
mypass = "1234"
system.net.sendEmail(smtp="mail.mycompany.com", from="myemail@mycompany.com", subject="Here is
```

Example 3:

```
# This code ask the user for an attachment file and attach the file.
filePath = fpmi.file.openFile()
if filePath != None:
   fileName = filePath.split("\\")[-1] # This gets the filename without the C:\folder stuff
   fileData = fpmi.file.readFileAsBytes(filePath)
   smtp = "mail.mycompany.com"
   sender = "myemail@mycompany.com"
   subject = "Here is the file you requested"
   body = "Hello, this is an email."
   recipients = ["bobsmith@mycompany.com"]
   system.net.sendEmail(smtp, sender, subject, body, 0, recipients, [fileName], [fileData])
```

11.10 system.opc

11.10.1 system.opc.getServerState

Description

Retreives the current state of the given OPC server connection. If the given server is not found, the return value will be `None`. Otherwise, the return value will be one of these strings:

UNKNOWN	FAULTED
CONNECTING	CLOSED
CONNECTED	DISABLED

Syntax

```
system.opc.getServerState(opcServer)
```

Parameters

String `opcServer` - The name of an OPC server connection.

Returns

String - A string representing the current state of the connection, or None if the connection doesn't exist.

Scope

All

11.10.2 system.opc.readValue

Description

Reads a single value directly from an OPC server connection. The address is specified as a string, for example, `[MyDevice]N11/N11:0`

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The object returned from this function has three attributes: `value`, `quality`, and `timestamp`. The `value` attribute represents the current value for the address specified. The `quality` attribute is an OPC-UA status code. You can easily check a good quality vs a bad quality by calling the `isGood()` function on the quality object. The `timestamp` attribute is Date object that represents the time that the value was retrieved at.

Syntax

```
system.opc.readValue(opcServer, itemPath)
```

Parameters

String `opcServer` - The name of the OPC server connection in which the item resides.
String `itemPath` - The item path, or address, to read from.

Returns

QualifiedValue - An object that contains the value, quality, and timestamp returned from the OPC server for the address specified.

Scope

All

11.10.3 system.opc.readValues

Description

This function is equivalent to the `system.opc.readValue` function, except that it can operate in bulk. You can specify a list of multiple addresses to read from, and you will receive a list of the same length, where each entry is the qualified value object for the corresponding address.

Syntax

```
system.opc.readValues(opcServer, itemPaths)
```

Parameters

String `opcServer` - The name of the OPC server connection in which the items reside.
String[] `itemPaths` - A list of strings, each representing an item path, or address to read from.

Returns

QualifiedValue[] - A sequence of objects, one for each address specified, in order. Each object will contains the value, quality, and timestamp returned from the OPC server for the corresponding address.

Scope

All

11.10.4 system.opc.writeValue

Description

Writes a value directly through an OPC server connection. Will return an OPC-UA status code object. You can quickly check if the write succeeded by calling `isGood()` on the return value from this function.

Syntax

```
system.opc.writeValue(opcServer, itemPath, value)
```

Parameters

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String `opcServer` - The name of the OPC server connection in which the item resides.
String `itemPath` - The item path, or address, to write to.
Object `value` - The value to write to the OPC item.

Returns
Quality - The status of the write. Use returnValue.getQuality.isGood() to check if the write succeeded.

Scope
All

11.10.5 system.opc.writeValues

Description

This function is a bulk version of `system.opc.writeValue`. It takes a list of addresses and a list of objects, which must be the same length. It will write the corresponding object to the corresponding address in bulk. It will return a list of status codes representing the individual write success or failure for each corresponding address.

Syntax

```
system.opc.writeValues(opcServer, itemPaths, values)
```

Parameters
String `opcServer` - The name of the OPC server connection in which the items reside.
String[] `itemPaths` - A list of item paths, or addresses, to write to.
Object[] `values` - A list of values to write to each address specified.

Returns
Quality[] - An array of Quality objects, each entry corresponding in order to the addresses specified.

Scope
All

11.11 system.print

11.11.1 system.print.createImage

Description

Advanced Function. Takes a snapshot of a component and creates a Java BufferedImage out of it. You can use javax.imageio.ImageIO to turn this into bytes that can be saved to a file or a BLOB field in a database.

Syntax

```
system.print.createImage(component)
```

Parameters
Component `component` - The component to render.

Returns
BufferedImage - A java.awt.image.BufferedImage representing the component.

Scope
Client

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11.11.2 system.print.createPrintJob

Description

Provides a general printing facility for printing the contents of a window or component to a printer. The general workflow for this function is that you create the print job, set the options you'd like on it, and then call `print()` on the job.

For printing reports or tables, use those components' dedicated print() functions.

The PrintJob object that this function returns has the following properties that can be set:

showPrintDialog	If true (1), then the print dialog window will be shown before printing. This allows users to specify printing options like orientation, printer, paper size, margins, etc. [default: 1]
fitToPage	If the component is too wide or tall to fit on a page, it will be proportionately zoomed out until it fits into the page. [default: 1]
zoomFactor	If greater than zero, this zoom factor will be used to zoom the printed image in or out. For example, if this is 0.5, the printed image will be half size. If used, this zoom factor overrides the fitToPage parameter. [default: -1.0]
orientation	Either `system.print.PORTRAIT` or `system.print.LANDSCAPE` [default: `system.print.PORTRAIT`]
pageWidth	The width of the paper in inches. [default: 8.5]
pageHeight	The height of the paper in inches. [default: 11]
leftMargin, rightMargin, topMargin, bottomMargin	The margins, specified in inches. [default: 0.75]

You can set all of the margins at once with `job.setMargins(number)`, and you initiate the printing with `job.print()`.

Syntax

system.print.**createPrintJob(**component**)**

Parameters

Component `component` - The component that you'd like to print.

Returns

JythonPrintJob - A print job that can then be customized and started.

Scope

Client

Examples

Put this code on a button to print out an image of the container the button is in

```
job = system.print.createPrintJob(event.source.parent)
job.setMargins(0.5)
job.zoomFactor = 0.75
job.showPageFormat = 0
job.print()
```

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11.11.3 system.print.printToImage

Description

This function prints the given component (such as a graph, container, entire window, etc) to an image file, and prompts the user to save the file to their hard drive.

Syntax

```
system.print.printToImage(component [, filename])
```

Parameters

Component `component` - The component to render.
String `filename` - A filename to save the image as. [optional]

Returns

nothing

Scope

Client

Examples

This code would go on a button and *save* an image of the container that it is in.

```
system.print.printToImage(event.source.parent, "Screen.jpg")
```

11.12 system.security

11.12.1 system.security.getRoles

Description

Finds the roles that the currently logged in user has, returns them as a Python tuple of strings.

Syntax

```
system.security.getRoles()
```

Parameters

none

Returns

PyTuple - A list of the roles (strings) that are assigned to the current user.

Scope

Client

Examples

This would run on a button to prevent certain users from opening a window

```
if "Supervisor" in system.security.getRoles():
   system.nav.openWindow("ManagementOnly")
else:
   system.gui.errorBox("You don't have sufficient privileges to continue")
```

11.12.2 system.security.getUserRoles

Description

Fetches the roles for a user from the Gateway. This may not be the currently logged in user. Requires the password for that user. If the authentication profile name is omitted, then the current project's default authentication profile is used.

Syntax

```
system.security.getUserRoles(username, password, authProfile, timeout)
```

Parameters

String `username` - The username to fetch roles for

String `password` - The password for the user

String `authProfile` - The name of the authentication profile to run against. Optional. Leaving this out will use the project's default profile.

Integer `timeout` - Timeout for client-to-gateway communication. (default: 60,000ms)

Returns

PyTuple - A list of the roles that this user has, if the user authenticates successfully. Otherwise, returns None.

Scope

Client

Examples

Fetch the roles for a given user, and check to see if the role "Admin" is in them.

```
reqRole = "Admin"
username = "Billy"
password= "Secret"
roles = system.security.getUserRoles(username, password)
if reqRole in roles:
   # do something requiring "Admin" role.
```

11.12.3 system.security.getUsername

Description

Returns the currently logged-in username.

Syntax

```
system.security.getUsername()
```

Parameters

none

Returns

String - The current user.

Scope

Client

Examples

This code would run on a startup script and do special logic based upon who was logging in

```
name = system.security.getUsername()
if name == 'Bob':
   system.nav.openWindow("BobsHomepage")
else:
```

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```
    system.nav.openWindow("NormalHomepage")
```

11.12.4 system.security.isScreenLocked

Description

Returns whether or not the screen is currently locked.

Syntax

```
system.security.isScreenLocked()
```

Parameters

none

Returns

boolean - A flag indicating whether or not the screen is currently locked.

Scope

Client

Examples

This would run in a timer script to lock the screen after 15 seconds of inactivity, and then log the user out after 30 seconds of inactivity.

```
if system.util.getInactivitySeconds() > 15 and not system.security.isScreenLocked():
    system.security.lockScreen()
elif system.util.getInactivitySeconds() > 30:
    system.security.logout()
```

11.12.5 system.security.lockScreen

Description

Used to put a running client in lock-screen mode. The screen can be unlocked by the user with the proper credentials, or by scripting via the `system.security.unlockScreen()` function.

Syntax

```
system.security.lockScreen([obscure])
```

Parameters

boolean `obscure` - If true(1), the locked screen will be opaque, otherwise it will be partially visible. [optional]

Returns

nothing

Scope

Client

Examples

This would run in a timer script to lock the screen after 15 seconds of inactivity, and then log the user out after 30 seconds of inactivity.

```
if system.util.getInactivitySeconds() > 15 and not system.security.isScreenLocked():
    system.security.lockScreen()
elif system.util.getInactivitySeconds() > 30:
    system.security.logout()
```

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11.12.6 system.security.logout

Description

Shuts-down the currently running client and brings the client to the login screen.

Syntax

```
system.security.logout()
```

Parameters

none

Returns

nothing

Scope

Client

Examples

This would run in a timer script to log the user out after 30 seconds of inactivity.

```
if system.util.getInactivitySeconds() > 30:
   system.security.logout()
```

See also:
system.util.getInactivitySeconds

11.12.7 system.security.switchUser

Description

Attempts to switch the current user on the fly. If the given username and password fail, this function will return false. If it succeeds, then all currently opened windows are closed, the user is switched, and windows are then re-opened in the states that they were in.

If an event object is passed to this function, the parent window of the event object will *not* be re-opened after a successful user switch. This is to support the common case of having a switch-user screen that you want to disappear after the switch takes place.

Syntax

```
system.security.switchUser(username, password, event, hideError)
```

Parameters

String `username` - The username to try and switch to.
String `password` - The password to authenticate with.
EventObject `event` - If specified, the enclosing window for this event's component will be closed in the switch user process.
Boolean `hideError` - If true (1), no error will be shown if the switch user function fails. (default: 0)

Returns

boolean - false(0) if the switch user operation failed, true (1) otherwise.

Scope

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Client

Examples

This script would go on a button in a popup window used to switch users without logging out of the client.

```
# Pull the username and password from the input components
uname = event.source.parent.getComponent("Username").text
pwd = event.source.parent.getComponent("Password").text

# Call switchUser. The event object is passed to this
# function so that if the username and password work,
# this window will be closed before the switch occurs.
success= system.security.switchUser(uname,pwd,event)

# If the login didn't work, give input focus back to the
# username component, so that the user can try again
if not success:
   event.source.parent.getComponent("Username").requestFocusInWindow()
```

11.12.8 system.security.unlockScreen

Description

Unlocks the client, if it is currently in lock-screen mode.

Syntax

system.security.**unlockScreen()**

Parameters

none

Returns

nothing

Scope

Client

Examples

This code would go in a global script to automatically unlock the screen on a specific computer

```
comp = system.net.getHostName()
if comp == 'Line 1':
   system.security.unlockScreen()
```

11.12.9 system.security.validateUser

Description

Tests credentials (username and password) against an authentication profile. Returns a boolean based upon whether or not the authentication profile accepts the credentials. If the authentication profile name is omitted, then the current project's default authentication profile is used.

Syntax

system.security.**validateUser(**username, password, authProfile, timeout**)**

Parameters

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String `username` - The username to validate
String `password` - The password for the user
String `authProfile` - The name of the authentication profile to run against. Optional. Leaving this out will use the project's default profile.
Integer `timeout` - Timeout for client-to-gateway communication. (default: 60,000ms)

Returns
boolean - false(0) if the user failed to authenticate, true(1) if the username/password was a valid combination.

Scope
Client

system.security.**validateUser(**username, password, authProfile, timeout**)**

Parameters
String `username`
String `password`
String `authProfile`
Integer `timeout`

Returns
boolean

Scope
Gateway

Examples

This would require the current user to enter their password again before proceeding.

```
currentUser = system.security.getUsername()
password = system.gui.passwordBox("Confirm Password")
valid = system.security.validateUser(currentUser, password)
if valid:
   # do something
else:
   system.gui.errorBox("Incorrect password")
```

11.13 system.serial

11.13.1 system.serial.closeSerialPort

Syntax

system.serial.**closeSerialPort(**??**)**

Parameters
String `??`

Returns
nothing

Scope
All

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11.13.2 system.serial.configureSerialPort

Description

Configure a serial port for use in a later call. This only needs to be done once unless the configuration has changed after the initial call. All access to constants must be prefixed by "`system.serial.`".

Syntax

system.serial.**`configureSerialPort(`**port, bitRate, dataBits, handshake, hardwareFlowControl, parity, stopBits**`)`**

Parameters

String `port` - The name of the serial port, e.g., "COM1" or "/dev/ttyS0". This parameter is required.

Integer `bitRate` - Configure the bit rate.Valid values are defined by the following constants: BIT_RATE_110, BIT_RATE_150, BIT_RATE_300, BIT_RATE_600, BIT_RATE_1200, BIT_RATE_2400, BIT_RATE_4800, BIT_RATE_9600, BIT_RATE_19200, BIT_RATE_38400, BIT_RATE_57600, BIT_RATE_115200, BIT_RATE_230400, BIT_RATE_460800, BIT_RATE_921600.

Integer `dataBits` - Configure the data bits.Valid values are defined by the following constants: DATA_BITS_5, DATA_BITS_6, DATA_BITS_7, DATA_BITS_8.

Integer `handshake` - Configure the handshake.Valid values are defined by the following constants: HANDSHAKE_CTS_DTR, HANDSHAKE_CTS_RTS, HANDSHAKE_DSR_DTR, HANDSHAKE_HARD_IN, HANDSHAKE_HARD_OUT, HANDSHAKE_NONE, HANDSHAKE_SOFT_IN, HANDSHAKE_SOFT_OUT, HANDSHAKE_SPLIT_MASK, HANDSHAKE_XON_XOFF.

Boolean `hardwareFlowControl` - Configure hardware flow control. On or off.

Integer `parity` - Configure parity.Valid values are defined by the following constants: PARITY_EVEN, PARITY_ODD, PARITY_MARK, PARITY_SPACE, PARITY_NONE.

Integer `stopBits` - Configure stop bits.Valid values are defined by the following constants: STOP_BITS_1, STOP_BITS_2.

Returns

SerialConfigurator

Scope

All

Examples

Configure a serial port using keyword args:

```
system.serial.configureSerialPort(\
port="COM1",\
bitRate=system.serial.BIT_RATE_9600,\
dataBits=system.serial.DATA_BITS_8,\
handshake=system.serial.HANDSHAKE_NONE,\
hardwareFlowControl=False,\
parity=system.serial.PARITY_NONE,\
stopBits=system.serial.STOP_BITS_1)
```

The "port" keyword is mandatory.

Configure a serial port using a SerialConfigurator (returned by `configureSerialPort()`):

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```
system.serial.configureSerialPort("COM1")\
.setBitRate(system.serial.BIT_RATE_9600)\
.setDataBits(system.serial.DATA_BITS_8)\
.setHandshake(system.serial.HANDSHAKE_NONE)\
.setHardwareFlowControl(False)\
.setParity(system.serial.PARITY_NONE)\
.setStopBits(system.serial.STOP_BITS_1)
```

11.13.3 system.serial.openSerialPort

Syntax

```
system.serial.openSerialPort(??)
```

Parameters

String `??`

Returns

nothing

Scope

All

11.13.4 system.serial.readBytes

Description

Read `numberOfBytes` bytes from a serial port.

Syntax

```
system.serial.readBytes(port, numberOfBytes [, timeout])
```

Parameters

String `port` - The previously configured serial port to use.
int `numberOfBytes` - The number of bytes to read.
int `timeout` - Maximum amount of time, in milliseconds, to block before returning. [optional]

Returns

byte[] - A byte[] containing bytes read from the serial port.

Scope

All

11.13.5 system.serial.readBytesAsString

Syntax

```
system.serial.readBytesAsString(port, numberOfBytes [, timeout])
```

Parameters

String `port` - The previously configured serial port to use.
int `numberOfBytes` - The number of bytes to read.
int `timeout` - Maximum amount of time, in milliseconds, to block before returning. [optional]

Returns

String - A String created from the bytes read.

Scope

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All

11.13.6 system.serial.readLine

Description

Read one line from a serial port.

Syntax

```
system.serial.readLine(port [, timeout] [, encoding])
```

Parameters

String `port` - The previously configured serial port to use.
int `timeout` - Maximum amount of time, in milliseconds, to block before returning. [optional]
String `encoding` - The String encoding to use. [optional]

Returns

String - A line of text. A line is considered to be terminated by any one of a line feed (' '), a carriage return (' '), or a carriage return followed immediately by a line feed.

Scope

All

11.13.7 system.serial.readUntil

Description

Read from a serial port until a delimiter character is encountered.

Syntax

```
system.serial.readUntil(port, delimiter, includeDelimiter)
```

Parameters

String `port` - The previously configured serial port to use.
char `delimiter` - The delimiter to read until.
boolean `includeDelimiter` - If true, the delimiter will be included in the return value.

Returns

String - Returns a String containing all characters read until the delimiter was reached, and including the delimiter if the "includeDelimiter" parameter was true.

Scope

All

11.13.8 system.serial.write

Description

Write a `String` to a serial port.

Syntax

```
system.serial.write(port, toWrite)
```

Parameters

String `port` - The previously configured serial port to use.
String `toWrite` - The String to write.

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Returns
nothing

Scope
All

11.13.9 system.serial.writeBytes

Description

Write a `byte[]` to a serial port.

Syntax

```
system.serial.writeBytes(port, toWrite)
```

Parameters
String `port` - The previously configured serial port to use.
byte[] `toWrite` - The byte[] to write.

Returns
nothing

Scope
All

11.14 system.tag

11.14.1 system.tag.exists

Description

Checks whether or not a tag exists. You pass this function a tag path, and it will evaluate true if the tag exists, otherwise false.

Syntax

```
system.tag.exists(tagPath)
```

Parameters
String `tagPath` - The path of the tag to look up

Returns
boolean

Scope
All

Examples

This code would write a 1 to the tag "`Compressors/C28/ClearFault`" if that tag exists.

```
if system.tag.exists("Compressors/C28/ClearFault"):
   system.tag.write("Compressors/C28/ClearFault", 1)
```

11.14.2 system.tag.isOverlaysEnabled

Description

Returns whether or not the current client's quality overlay system is currently enabled.

Syntax

```
system.tag.isOverlaysEnabled()
```

Parameters

none

Returns

boolean - True (1) if overlays are currently enabled.

Scope

Client

11.14.3 system.tag.queryTagDensity

Description

Queries the tag history system for information about the *density* of data. In other words, how much data is available for a given time span.

This function is called with a list of tag paths, and a start and end data. The result set is a two column dataset specifying the timestamp, and a relative weight. Each row is valid from the given time until the next row. The weight is normalized to a value of 1.0 for each tag with data during that time. Thus, for three tag paths passed in, if all tags were present during the span, the result would be 3.0.

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

```
system.tag.queryTagDensity(paths, startDate, endDate)
```

Parameters

PySequence `paths` - An array of tag paths (strings) to query.
Date `startDate` - The start of the range to query.
Date `endDate` - The end of the range to query.

Returns

Dataset - A 2-column dataset consisting of a timestamp and a weight. Each row is valid until the next row. The weight is 1 point for each tag with data present.

Scope

All

11.14.4 system.tag.queryTagHistory

Description

Issues a query to to the SQLTags Historian. Querying tag history involves specifying the tags and the date range, as well as a few optional parameters. The SQLTags historian will find the relevant history and then interpolate and aggregate it together into a coherent, tabular result set.

This function takes a list of strings, where each string is a *tag path*, like `"Tanks/Tank5"` or `"[OracleProvider]Sump/Out2"`. See also: Tag Paths.

The return size determines how the underlying data is aggregated and/or interpolated. If a distinct return size is specified, that will be the number of rows in the resulting dataset. The special numbers

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0 and -1 mean "Natural" and "On-Change", respectively. "Natural" calculates a return size based on the rate of the logging historical scan classes. For example, if you query 1 hour of data for a scan class logging every minute, the natural return size is 60. "On-Change means that you'll get an entry whenever any of the tags under consideration have changed.

Instead of defining a fixed return size, the parameters `intervalHours` and `intervalMinutes` can be used. These parameters can be used independently or together to define a "window size". For example, if you defined a 1 hour range, with intervalMinutes=15, you would get 4 rows as a result.

The span of the query can be specified using `startDate` and `endDate`. You can also use `rangeHours` and `rangeMinutes` in conjunction with either start or end date to specify the range in dynamic terms. For example, you could specify only "rangeHours=-8" to get the last 8 hours from the current time. Or you could use "startDate='2012-05-30 00:00:00', rangeHours=12" to get the first half of the day for May 30th, 2012.

The aggregation mode is used when the data is denser than what you asked for. This happens when using fixed return sizes, as there will often be multiple raw values for the window interval defined. Another common operation is to set the return size to 1, in order to use these aggregate functions for calculation purposes. The available functions are:
"MinMax" - will return two entries per time slice - the min and the max.
"Average" - will return the *time-weighted* average value of all samples in that time slice.
"LastValue" - returns the most recent actual value to the end of the window.
"SimpleAverage" - returns the simple mathematical average of the values - $((V_1+V_2+...+V_n)/n)$

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

system.tag.**queryTagHistory(**paths, startDate, endDate, returnSize, aggregationMode, returnFormat, columnNames, intervalHours, intervalMinutes, rangeHours, rangeMinutes**)**

Parameters

PySequence `paths` - An array of tag paths (strings) to query. Each tag path specified will be a column in the result dataset.
Date `startDate` - The earliest value to retrieve. If omitted, 8 hours before current time is used.
Date `endDate` - The latest value to retrieve. If omitted, current time is used.
Integer `returnSize` - The number of samples to return. -1 will return values as they changed, and 0 will return the "natural" number of values based on the logging rates of the scan class (es) involved. -1 is the default.
String `aggregationMode` - The mode to use when aggregating multiple samples into one time slice. Must be one of "Average" or "MinMax".
String `returnFormat` - Use "Wide" to have a column per tag queried, or "Tall" to have a fixed-column format. Default is "Wide".
PySequence `columnNames` - Aliases that will be used to override the column names in the result dataset. Must be 1-to-1 with the tag paths. If not specified, the tag paths themselves will be used as column titles.
Integer `intervalHours` - Allows you to specify the window interval in terms of hours, as opposed to using a specific return size.
Integer `intervalMinutes` - Same as intervalHours, but in minutes. Can be used on its own, or in conjunction with intervalHours.
Integer `rangeHours` - Allows you to specify the query range in hours, instead of using start and end date. Can be positive or negative, and can be used in conjunction with startDate or

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endDate.

Integer `rangeMinutes` - Same as rangeHours, but in minutes.

Returns

Dataset - A dataset representing the historian values for the specified tag paths. The first column will be the timestamp, and each column after that represents a tag.

Scope

All

11.14.5 system.tag.read

Description

Reads the value of the tag at the given tag path. Returns a qualified value object. You can read the value, quality, and timestamp from this object. If the tag path does not specify a tag property, then the Value property is assumed.

Syntax

```
system.tag.read(tagPath)
```

Parameters

String `tagPath` - Reads from the given tag path. If no property is specified in the path, the Value property is assumed.

Returns

QualifiedValue - A qualified value. This object has three sub-members: value, quality, and timestamp.

Scope

All

Examples

This example would read a value and display it in a message box.

```
qv = system.tag.read("[]EastSection/ValveG/HOA_bit")
system.gui.messageBox("The value is %d" % qv.value)
```

This example would check the quality of a tag value, and write it to the database if the quality is good

```
qv = system.tag.read("[]EastSection/ValveG/HOA_bit")
if qv.quality.isGood():
   system.db.runPrepQuery("INSERT INTO VALVE_TABLE (HOA) VALUES (?)", qv.value)
```

11.14.6 system.tag.readAll

Description

Reads the values of each tag in the tag path list. Returns a sequence of qualified value objects. You can read the value, quality, and timestamp from each object in the return sequence. Reading in bulk like this is more efficient than calling `read()` many times.

Syntax

```
system.tag.readAll(tagPaths)
```

Parameters

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String[] `tagPaths` - A sequence of tag paths to read from.

Returns

QualifiedValue[] - A sequence of qualified values corresponding to each tag path given. Each qualified value will have three sub-members: value, quality, and timestamp.

Scope

All

Examples

This example would read 5 tags at once and print each of their values

```
tags = ["Tags/T1", "Tags/T2", "Tags/T3", "Tags/T4", "Tags/T5"]
values = system.tag.readAll(tags)
for x in range(len(tags)):
   print "%s = %s" % (tags[x], values[x])
```

11.14.7 system.tag.setOverlaysEnabled

Description

Enables or disables the component quality overlay system.

Syntax

```
system.tag.setOverlaysEnabled(enabled)
```

Parameters

boolean `enabled` - True (1) to turn on tag overlays, false (0) to turn them off.

Returns

nothing

Scope

Client

11.14.8 system.tag.write

Description

Writes a value to a tag. Note that this function writes *asynchronously*. This means that the function does not wait for the write to occur before returning - the write occurs sometime later on a different thread.

Syntax

```
system.tag.write(tagPath, value, suppressErrors)
```

Parameters

String `tagPath` - The path of the tag to write to.

Object `value` - The value to write.

Boolean `suppressErrors` - A flag indicating whether or not to suppress errors. (optional, client-only).

Returns

int - 0 if the write failed immediately, 1 if it succeeded immediately, and 2 if it is pending.

Scope

All

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Examples

This code would go on a property change event for a numeric text field to calculate and write a value to a tag.

```
if event.propertyName == intValue:
    calcValue = event.newValue * 2.5
    system.tag.write("Tanks/tankHiSP",calcValue)
```

11.14.9 system.tag.writeAll

Description

Performs a bulk write. Take two sequences that must have the same number of entries. The first is the list of tag paths to write to, and then second is a list of values to write. This function is dramatically more efficient than calling write multiple times.

Syntax

```
system.tag.writeAll(tagPaths, values)
```

Parameters

String[] `tagPaths` - The paths of the tags to write to.
Object[] `values` - The values to write.

Returns

int[] - Array of ints with an element for each tag written to: 0 if the write failed immediately, 1 if it succeeded immediately, and 2 if it is pending.

Scope

All

Examples

This code write to 5 tags at once.

```
tags = ["Tags/T1", "Tags/T2", "Tags/T3", "Tags/T4", "Tags/T5"]
values = [2, 4, 8, 16, 32]
values = system.tag.writeAll(tags,values)
```

11.14.10 system.tag.writeSynchronous

Description

Writes a value to a tag, synchronously. This means that you know at the end of this function whether or not the write succeeded or not. However, this function cannot be called from the event dispatch thread, which means that it cannot be called directly from a GUI event like a button press, without wrapping it in a system.util.invokeAsynchronous. You can call this from project event scripts like timer scripts.

Syntax

```
system.tag.writeSynchronous(tagPath, value [, timeout])
```

Parameters

String `tagPath` - The path of the tag to write to.
Object `value` - The value to write.

int `timeout` - How long to wait before timing out. [optional]

Returns
nothing

Scope
All

Examples

This code would write to a tag and wait before continuing on.

```
system.tag.writeSynchronous("Tags/T5", 38)
# this line will not be reached until the tag is written
```

11.15 system.user

11.15.1 system.user.getRoles

Description

Returns a sequence of strings representing all of the roles configured in a specific user source.

Syntax

```
system.user.getRoles(??)
```

Parameters
String `??`

Returns
List

Scope
All

11.15.2 system.user.getUser

Description

Looks up a specific user in a user source, by username. The full User object is returned. See the docs for `system.user.getUsers` for more information about the User object type.

Syntax

```
system.user.getUser(??, ??)
```

Parameters
String `??`
String `??`

Returns
User

Scope
All

11.15.3 system.user.getUsers

Description

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Retrieves the list of users in a specific user source. The "User" objects that are returned contain all of the information about that user, except for the user's password. You can access most of the basic user properties via a call to "get" or "getOrDefault" which returns a default value if the requested item is not present. For example:

```
user.getOrDefault(User.Schedule)
```

...will return that user's schedule, or the value of "Always" if no schedule has been set as that is the default schedule. The following are the various values you may use in this manner:

```
User.Username
User.FirstName
User.LastName
User.Notes
User.Schedule
User.Language
```

In addition to these properties, the user object has other methods on it to retrieve more information:

`User.getId()` - returns the internal identifier object that the backing user source needs to identify this user
`User.getRoles()` - returns a sequence of strings representing the roles that this user belongs to
`User.getContactInfo()` - returns a sequence of `ContactInfo` objects. Each of these objects will have a `contactType` and `value` property representing the contact information, both strings.
`User.getScheduleAdjustments()` - returns a sequence of `ScheduleAdjustment` objects. Each of these objects will have two date properties, "`start`" and "`end`", a boolean property, "`available`", and a string property called "`note`".
`User.getPath()` - returns a `QualifiedPath` object that represents this user in a deterministic manner.

Syntax

```
system.user.getUsers(??)
```

Parameters
String `??`

Returns
List

Scope
All

11.16 system.util

11.16.1 system.util.beep

Description

Tells the computer to make a "beep" sound.

Syntax

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```
system.util.beep()
```

Parameters
none

Returns
nothing

Scope
All

11.16.2 system.util.execute

Description

Executes the given commands via the operating system, in a separate process The commands argument is an array of strings. The first string is the program to execute, with subsequent strings being the arguments to that command.

Syntax

```
system.util.execute(commands)
```

Parameters
String[] `commands` - A list containing the command (1st entry) and associated arguments (remaining entries) to execute.

Returns
nothing

Scope
All

Examples

```
# This code would work on a Windows system to play a sound file.
system.util.execute(["sndrec32", "/play", "/close", "/embedding", "C:\\somethingwrong.wav"])
```

11.16.3 system.util.exit

Description

Exits the running client, as long as the *shutdown intercept* script doesn't cancel the shutdown event. Set `force` to true to not give the shutdown intercept script a chance to cancel the exit. Note that this will quit the Client completely. you can use `system.security.logout()` to return to the login screen.

Syntax

```
system.util.exit([force])
```

Parameters
boolean `force` - If true (1), the shutdown-intercept script will be skipped. Default is false (0). [optional]

Returns
nothing

Scope
Client

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Examples

```
# This code would exit the client after confirming with the user.
if system.gui.confirm("Are you sure you want to exit?"):
   system.util.exit()
```

11.16.4 system.util.getClientId

Description

Returns a hex-string that represents a number unique to the running client's session. You are guaranteed that this number is unique between all running clients.

Syntax

```
system.util.getClientId()
```

Parameters

none

Returns

String - A special code representing the client's session in a unique way.

Scope

Client

Examples

```
# This code would print the current client's id to the debug console.
id = system.util.getClientId()
print id
```

11.16.5 system.util.getConnectTimeout

Description

Returns the connect timeout in milliseconds for all client-to-gateway communication. This is the maximum amount of time that communication operations to the Gateway will be given to connect. The default is 10,000ms (10 seconds).

Syntax

```
system.util.getConnectTimeout()
```

Parameters

none

Returns

int - The current connect timeout, in milliseconds. Default is 10,000 (ten seconds)

Scope

Client

Examples

```
# This code would print out the current connect timeout
print system.util.getConnectTimeout()
```

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11.16.6 system.util.getConnectionMode

Description

Retrieves this client session's current connection mode. 3 is read/write, 2 is read-only, and 1 is disconnected.

Syntax

```
system.util.getConnectionMode()
```

Parameters

none

Returns

int - The current connection mode for the client.

Scope

Client

11.16.7 system.util.getEdition

Description

Returns the "edition" of the Vision client - "standard", "limited", or "panel".

Syntax

```
system.util.getEdition()
```

Parameters

none

Returns

String - The edition of the Vision module that is running the client.

Scope

Client

11.16.8 system.util.getGatewayAddress

Description

Returns the address of the gateway that the client is currently communicating with.

Syntax

```
system.util.getGatewayAddress()
```

Parameters

none

Returns

String - the address of the Gateway that the client is communicating with.

Scope

Client

Examples

```
# This code would open up the gateway config page.
address = system.util.getGatewayAddress()
```

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```
system.net.openURL("%s/web/config/" % address)
```

11.16.9 system.util.getInactivitySeconds

Description

Returns the number of seconds since any keyboard or mouse activity. Note - this function will always return zero in the Designer.

Syntax

```
system.util.getInactivitySeconds()
```

Parameters

none

Returns

long - The number of seconds the mouse and keyboard have been inactive for this client.

Scope

Client

Examples

```
# This code could run in a global timer script.
# After a 5-minute timeout, navigate back to the home screen
if system.util.getInactivitySeconds() > 300 and system.nav.getCurrentWindow() != "HomeScreen":
    system.nav.swapTo("HomeScreen")
```

11.16.1(system.util.getProjectName

Description

Returns the name of the project that is currently being run.

Syntax

```
system.util.getProjectName()
```

Parameters

none

Returns

String - The name of the currently running project.

Scope

Client

Examples

```
# This code would display the name of the currently running project
system.gui.messageBox("You are running project: %s" % system.util.getProjectName())
```

11.16.1′system.util.getProperty

Description

Retrieves the value of a named system property. Some of the available properties are:
file.separator. The system file separator character. (for example, "/" (unix) or "\" (windows))

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line.separator. The system line separator string. (for example, "\r\n" (carriage return, newline))
os.arch. Operating system architecture. (for example, "x86")
os.name. Operating system name. (for example, "Windows XP")
os.version. Operating system version. (for example, "5.1")
user.home. User's home directory.
user.name. User's account name.

Syntax

```
system.util.getProperty(propertyName)
```

Parameters

String `propertyName` - The name of the system property to get.

Returns

String - The value for the named property.

Scope

All

Examples

This script would store the contents of the Text Area component in the users home directory.

```
homeDir = system.util.getProperty("user.home")
sep = system.util.getProperty("file.separator")
path = "%s%smyfile.txt" %(homeDir, sep)
system.file.writeFile(path, event.source.parent.getComponent("Text Area").text)
```

11.16.12 system.util.getReadTimeout

Description

Returns the read timeout in milliseconds for all client-to-gateway communication. This is the maximum amount of time allowed for a communication operation to complete. The default is 60,000ms (1 minute).

Syntax

```
system.util.getReadTimeout()
```

Parameters

none

Returns

int - The current read timeout, in milliseconds. Default is 60,000 (one minute)

Scope

Client

11.16.13 system.util.getSessionInfo

Description

Returns a PyDataSet holding information about all of the sessions (logged-in users) on the Gateway. Optional regular-expression based filters can be provided to filter the username or the username and the project returned.

The PyDataSet returned has these columns:

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`username` (String)
`project` (String)
`address` (String)
`isDesigner` (Boolean)
`clientId` (String)
`creationTime` (Date)

Note that this function will not return all sessions across a cluster - only the cluster node that is being communicated with by the client who makes the call.

Syntax

system.util.**getSessionInfo([**usernameFilter**] [**, projectFilter**])**

Parameters

String `usernameFilter` - A filter string to restrict the list by username. * matches anything, ? matches one character. [optional]

String `projectFilter` - A filter string to restrict the list by project. * matches anything, ? matches one character. [optional]

Returns

PyDataSet - A dataset representing the Gateway's current sessions.

Scope

Client

Examples

Example 1:

```
# This code would get the entire table of sessions and put it in an adjacent table
table = event.source.parent.getComponent("Table")
sessions = system.util.getSessionInfo()
table.data = system.db.toDataSet(sessions)
```

Example 2:

```
# This code would count the number of times a user named "billy" is logged in
sessions = system.util.getSessionInfo("billy")
system.gui.messageBox("Billy has %d sessions" % len(sessions))
```

11.16.14 system.util.getSystemFlags

Description

Returns an integer that represents a *bit field* containing information about the currently running system. Each bit corresponds to a public bitmask as defined below. See the examples for tips on how to extract the information in this bit field are in the examples. Note that the tag `[System]Client/System/SystemFlags` contains the same value.

`system.util.DESIGNER_FLAG`. Set if running in the Designer. (1)
`system.util.PREVIEW_FLAG`. Set if running in the Designer, and the Designer is in preview mode. (2)
`system.util.CLIENT_FLAG`. Set if running as a Client. (4)
`system.util.WEBSTART_FLAG`. Set if running as a Client in Web Start mode. (8)
`system.util.APPLET_FLAG`. Set if running as a Client in Applet mode. (16)

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`system.util.FULLSCREEN_FLAG`. Set if running as a Client in full-screen mode. (32)
`system.util.SSL_FLAG`. Set if communication to the Gateway is encrypted with SSL. (64)
`system.util.MOBILE_FLAG`. Set if currently running a mobile-launched client. (128)
`system.util.STAGING_FLAG`. Set if running a staging client. (256)

Syntax

```
system.util.getSystemFlags()
```

Parameters
none

Returns
int - The system flags integer.

Scope
Client

11.16.15 system.util.invokeAsynchronous

Description

This is an advanced scripting function. Invokes (calls) the given Python function on a different thread. This means that calls to `invokeAsynchronous` will return immediately, and then the given function will start executing asynchronously on a different thread. This is useful for long-running data intensive functions, where running them synchronously (in the GUI thread) would make the GUI non-responsive for an unacceptable amount of time.

⚠ WARNING: Under no circumstances should you ever do anything in the function that is invoked asynchronously that interacts with the GUI. This means things like window navigation, setting and getting component properties, showing error/message popups, etc. If you need to do something with the GUI in this function, this must be achieved through a call to `system.util.invokeLater`.

Syntax

```
system.util.invokeAsynchronous(function)
```

Parameters
PyObject `function` - A python function object that will get invoked with no arguments in a separate thread.

Returns
nothing

Scope
All

Examples

```
# This code would do some data-intensive processing, and then call
# back to the GUI to let it know that it is finished.
# We use default function parameters to pass the root container into these
# functions. (See a Python reference if you don't understand this)

def longProcess(rootContainer = event.source.parent):
   import system
   # Do something here with the database that takes a long time
   results = ...( something )
   # Now we'll send our results back to the UI
```

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```
   def sendBack(results = results, rootContainer = rootContainer):
      rootContainer.resultsProperty = results
   system.util.invokeLater(sendBack)

system.util.invokeAsynchronous(longProcess)
```

11.16.16 system.util.invokeLater

Description

This is an advanced scripting function. Invokes (calls) the given Python function object after all of the currently processing and pending events are done being processed, or after a specified delay. The function will be executed on the GUI, or event dispatch, thread. This is useful for events like *propertyChange* events, where the script is called before any bindings are evaluated.

If you specify an optional time argument (number of milliseconds), the function will be invoked after all currently processing and pending events are processed *plus* the duration of that time.

Syntax

```
system.util.invokeLater(function [, delay])
```

Parameters

PyObject `function` - A Python function object that will be invoked later, on the GUI, or event-dispatch, thread with no arguments.

int `delay` - A delay, in milliseconds, to wait before the function is invoked. The default is 0, which means it will be invoked after all currently pending events are processed. [optional]

Returns

nothing

Scope

Client

Examples

```
# The code in the update/refresh button uses the 'date' property on the two calendar components
# which are bound to the current_timestamp property on their parent. We want to simulate a butt
# press when the window opens, but only after the date properties' bindings have been evaluated

if event.propertyName == 'current_timestamp':
   # Define a function to click the button
   def clickButton(button = event.source.parent.getComponent('Refresh')):
      import system
      button.doClick()
      system.gui.messageBox("Button has been clicked!")

   # Tell the system to invoke the function after
   # the current event has been processed
   system.util.invokeLater(clickButton)
```

11.16.17 system.util.jsonDecode

Syntax

```
system.util.jsonDecode(jsonString)
```

Parameters
String `jsonString` - The JSON string to decode into a python object.

Returns
PyObject - The decoded python object.

Scope
All

11.16.18 system.util.jsonEncode

Syntax

```
system.util.jsonEncode(pyObj)
```

Parameters
PyObject `pyObj` - The python object to encode into JSON such as a python list or dictionary.

Returns
String - The encoded JSON string.

Scope
All

11.16.19 system.util.playSoundClip

Description

Plays a sound clip from a `wav` file to the system's default audio device. The `wav` file can be specified as a filepath, a URL, or directly as a raw byte[].

Syntax

```
system.util.playSoundClip(wavFile)
```

Parameters
String `wavFile` - A filepath or URL that represents a wav file

Returns
nothing

Scope
All

```
system.util.playSoundClip(wavFile [, volume] [, wait])
```

Parameters
String `wavFile` - A filepath or URL that represents a wav file
double `volume` - The clip's volume, represented as a floating point number between 0.0 and 1.0 [optional]
boolean `wait` - A boolean flag indicating whether or not the call to playSoundClip should wait for the clip to finish before it returns [optional]

Returns
nothing

Scope
All

```
system.util.playSoundClip(wavBytes [, volume] [, wait])
```

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Parameters

byte[] `wavBytes`

double `volume` - The clip's volume, represented as a floating point number between 0.0 and 1.0 [optional]

boolean `wait` - A boolean flag indicating whether or not the call to playSoundClip should wait for the clip to finish before it returns [optional]

Returns

nothing

Scope

All

Examples

Example 1:

```
# This code would play a sound clip at full volume that was located on the current host's files
# It will not return until the clip in finished playing
system.util.playSoundClip("C:\\sounds\\siren.wav")
```

Example 2:

```
# This code would pull a sound clip out of a BLOB field from a database, playing it asynchronou

soundData = system.db.runScalarQuery("SELECT wavBlob FROM sounds WHERE type='alert_high'")

system.util.playSoundClip(soundData, 0.5, 0)
```

11.16.2(system.util.queryAuditLog

Description

Queries an audit profile for audit history. Returns the results as a dataset.

This function accepts *keyword-style* invocation. See also: Functions / Keyword Invocation

Syntax

system.util.**queryAuditLog(**auditProfileName, startDate, endDate, actorFilter, actionFilter, targetFilter, valueFilter, systemFilter, contextFilter**)**

Parameters

String `auditProfileName` - The name of the audit profile to pull the history from.

Date `startDate` - The earliest audit event to return. If omitted, the current time - 8 hours will be used.

Date `endDate` - The latest audit evnet to return. If omitted, the current time will be used.

String `actorFilter` - A filter string used to restrict the results by actor.

String `actionFilter` - A filter string used to restrict the results by action.

String `targetFilter` - A filter string used to restrict the results by target.

String `valueFilter` - A filter string used to restrict the results by value.

String `systemFilter` - A filter string used to restrict the results by system.

Integer `contextFilter` - A bitmask used to restrict the results by context. 0x01 = Gateway, 0x02 = Designer, 0x04 = Client.

Returns

Dataset - A dataset with the audit events from the specified profile that match the filter

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arguments.

Scope
Client

11.16.2 system.util.retarget

Description

This function allows you to programmatically 'retarget' the Client to a different project and/or different Gateway. You can have it switch to another project on the same Gateway, or another gateway entirely, even across a WAN. This feature makes the vision of a seamless, enterprise-wide SCADA application a reality.

The retarget feature will attempt to transfer the current user credentials over to the new project / Gateway. If the credentials fail on that project, the user will be prompted for a valid username and password, with an option to cancel the retargeting and return to the original project. One valid authentication has been achieved, the currently running project is shut down, and the new project is loaded.

You can pass any information to the other project through the `parameters` dictionary. All entries in this dictionary will be set in the global scripting namespace in the other project. Even if you don't specify any parameters, the system will set the variable `_RETARGET_FROM_PROJECT` to the name of the current project and `_RETARGET_FROM_GATEWAY` to the address of the current Gateway.

Syntax

system.util.**retarget(**projectName **[**, gatewayAddress**] [**, params**] [**, startupWindows**])**

Parameters

String `projectName` - The name of the project to retarget to.
String `gatewayAddress` - The address of the Gateway that the project resides on. If omitted, the current Gateway will be used. Format is: "host:httpPort:sslPort/contextName" [optional]
PyDictionary `params` - A dictionary of parameters that will be passed to the new project. They will be set as global variables in the new project's Python scripting environment. [optional]
String[] `startupWindows` - A list of window names to use as the startup windows. If omitted, the project's normal startup windows will be opened. If specified, the project's normal startup windows will be ignored, and this list will be used instead. [optional]

Returns
nothing

Scope
Client

Examples

Example 1:

```
# This code would switch to a project named 'TankControl' on the same Gateway
# as the currently running project
system.util.retarget("TankControl")
```

Example 2:

```
# This code would switch to a project named 'TankControl' on a
# Gateway located at a different IP address running on port 8080, and
```

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```
# would open the window named "Graph", and set a global jython variable in the new
# project named "retargetOccured" to the value 1 (one).
system.util.retarget("TankControl", "10.30.2.33:8088/main", {"retargetOccured":1}, ["Graph"])
```

Example 3:

```
# This code would be put in a button in the target that was retargetted to,
# and act as a 'back' button, that would retarget back to the original project.

global _RETARGET_FROM_PROJECT
global _RETARGET_FROM_GATEWAY

# _RETARGET_FROM_GATEWAY is formatted like 'http://10.1.10.1:8088/main', so you have to remove
system.util.retarget(_RETARGET_FROM_PROJECT, _RETARGET_FROM_GATEWAY[7:])
```

11.16.2 system.util.setConnectTimeout

Description

Sets the connect timeout for client-to-gateway communication. Specified in milliseconds.

Syntax

```
system.util.setConnectTimeout(connectTimeout)
```

Parameters

int `connectTimeout` - The new connect timeout, specified in milliseconds.

Returns

nothing

Scope

Client

Examples

```
# This code would set the current connect timeout to 30 seconds
system.util.setConnectTimeout(30000)
```

11.16.2 system.util.setConnectionMode

Description

Sets the connection mode for the client session. Normally a client runs in mode 3, which is read-write. You may wish to change this to mode 2, which is read-only, which will only allow reading and subscribing to tags, and running SELECT queries. Tag writes and INSERT / UPDATE / DELETE queries will not function. You can also set the connection mode to mode 1, which is disconnected, all tag and query features will not work.

Syntax

```
system.util.setConnectionMode(mode)
```

Parameters

int `mode` - The new connection mode. 1 = Disconnected, 2 = Read-only, 3 = Read/Write.

Returns

nothing

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Scope
Client

Examples

This example, which could go in a project's startup script, would check the current username and set the connection mode to read-only if it is the "guest" user.

```
username = system.security.getUsername()
if "guest" == username.lower():
   # Set "guest" user to read-only mode
   system.util.setConnectionMode(2)
else:
   system.util.setConnectionMode(3)
```

11.16.2 system.util.setReadTimeout

Description

Sets the read timeout for client-to-gateway communication. Specified in milliseconds.

Syntax

```
system.util.setReadTimeout(readTimeout)
```

Parameters
int `readTimeout` - The new read timeout, specified in milliseconds.

Returns
nothing

Scope
Client

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